

SOUTH MOSMAN PARK BUSHLAND MANAGEMENT PLAN

TOWN OF MOSMAN PARK

Prepared by:

Ecoscape (Australia) Pty Ltd

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1.0 Introduction

South Mosman Park Bushland Management Plan

1.1 Background

The South Mosman Park Bushland is located within the Town of Mosman Park and is situated adjacent to the Swan River. It is a part of the Bush Forever Site 335 and is recognised as containing the only population on the mainland in the Perth Region of the species *Boronia alata*.

It also has a National Trust of Australia (WA) classification due to the presence of exposed Marine Shell Beds containing fossil fauna and is one of the very limited numbers of bushland areas on the Swan Estuary that has particular conservation value in providing habitat for fauna and linkage between areas of bushland.

The bushland has been subject to various environmental disturbances such as uncontrolled access and arson. This has resulted in the introduction and spread of weeds which has contributed to the decline in biodiversity values of the site.

Previous land uses such as landfill have denuded much of the original vegetation and exotic species have invaded the area, particularly the giant reed (*Arundo donax*), often mistaken for bamboo, found proliferating on the foreshore, while the areas to the north contain infestations of Perennial Veldt Grass (*Ehrharta calycina*), Fountain Grass (*Pennisetum setaceum*), Soursob (*Oxalis pes-caprae*) and Western Blue Lupins (*Lupinus cosentinii*).

Much of the adjacent area is used for recreation with the bushland surrounded by landscaped parklands. The foreshore is formed by cliff and as such affords little access to the general public. Informal tracks have been made to the water level however they are eroding the site.

The Town of Mosman Park has recognised the intrinsic ecological and social values of the site which has resulted in the preparation of this Environmental Management Plan (EMP) for the South Mosman Park Bushland. The Plan includes a comprehensive vegetation survey detailing the existing environment to help determine possible conservation and restoration strategies to provide future direction for the bushland.

1.2 Management Plan Objectives

The objectives for the Management Plan include:

- balancing conservation and recreation, in an ecological sustainable manner and taking into account the regional significance of the reserve
- involving the public in shared ownership, responsibility and management
- rehabilitating of degraded natural areas
- protecting flora, fauna and ancient shell bed values
- regulating public access.

2.0 Existing Environment

South Mosman Park Bushland Management Plan

2.1 Land Ownership and Vesting

The study area is contained on Reserves 31156, 31157 and on a small portion of Unallocated Crown Land (UCL). All three areas are C class Reserves vested with the Town of Mosman Park (**Appendix One, Maps 1 and 2**). They are zoned as Parks and Recreation under both the Metropolitan Region Scheme (MRS) and the Town of Mosman Park's Town Planning Scheme No 2.

2.2 Geology

The landscape of the area is made up of Tamala limestone commonly known as Coastal Limestone and dates back to the Pleistocene Age (Playford, Cockbain & Low 1976). The rock is composed of a cemented dune sand (aeolianite) consisting of shell fragments of marine origin and quartz grains in calcium carbonate (Ecoscape 1990; Playford, Cockbain & Low 1976).

2.3 Geomorphology and Soils

The Swan Coastal Plain is made up of three dune systems. The Bassendean Dune System, containing low hills and leached infertile soils. This system is the most easterly and the oldest for the three systems. West of this is the Spearwood Dune System which is younger with higher hills and less leached soils. Even further west is the youngest of the dune systems and known as the Quindalup Dune System. This system is composed of calcareous dune sands forming along the coastline (Ecoscape 1990).

The study area is found within the Spearwood Dune System. Topographically this system is more variable and undulating and as such contains greater relief. The hills are higher and the soils are younger. It is within this system that the coastal limestone has been formed by a process of leaching and deposition of surface soil carbonate (Ecoscape 1990; Playford, Cockbain & Low 1976).

The soils of the Mosman Park area are derived from the weathering of the limestone rock, giving rise to a soil profile which consists of shallow yellow and brown sands overlying limestone. There are deeper soils that occur in the valleys or swale areas while the shallow soils are associated with the more exposed and elevated limestone hilltops.

These soils are referred to as the Cottesloe Soil Association (Seddon 1972) and are regarded as naturally fertile (Ecoscape 1990).

2.4 Vegetation

Prior to European settlement the Leighton Peninsula would have contained a number of plant communities in response to the variety of environmental conditions found in the area. Today only remnants of the original communities can be found within the study area.

2.4.1 Vegetation Complexes

Three pre-European broad complex types described in Seddon (1972) are associated with the study area, and are detailed below.

Limestone Heathland

The shallow soils over limestone, exposed windy environments and limited nutrients give rise to typical limestone heath communities. These are associated with the limestone hills, ridges and parts of the cliff face forming the river foreshore.

Generally the heath communities are low and have a diverse flora composition. Many species are represented including *Acacia cuneata*, *Acacia rostelifera*, *Acacia xanthina*, *Grevillea thelemanniana*, *Melaleuca huegelii*, *Melaleuca systema*, *Spyridium globulosum*, *Templetonia retusa* and *Xanthorrhoea preissii*.

Tuart Woodland

On the deeper soils under more sheltered conditions woodlands to open forests of Tuarts (*Eucalyptus gomphocephala*) as the dominant species along with Jarrah, Marri and in some cases Limestone Marlock (*Eucalyptus decipiens*).

This community also supports a middle stratum containing such species as Banksia, peppermints (*Agonis flexuosa*), Christmas tree (*Nuytsia floribunda*) and Sheoak (*Allocasuarina fraseriana*). Shrubs such as *Jacksonia sternbergiana*, *Hakea prostrata*, *Banksia sessilis* and *Acacia cyclops* were also found. A diverse lower storey is also associated with this community.

Low Closed-Forest

This community was found on the cliffs and dominated by Rottneest Island Pine (*Callitris preissii*) (Seddon 1972). Out of all the communities this one no longer exists in its true form due to repeated fire and clearing.

Other species found in this community include the, *Acacia xanthina*, *Agonis flexuosa*, *Eremophila glabra*, *Phyllanthus calycinus* and *Spyridium globulosum*.

2.4.2 Vegetation Communities

There were nine vegetation communities mapped (**Appendix One; Map 3**) within the South Mosman Park Bushland Reserve according to Keighery (1994) which are described below.

Cliff top

Acacia xanthina and *Acacia saligna* Tall Open Scrub over Closed Herbland/Grassland of mixed annual weeds

Cliff top near stairs

Acacia rostelifera and *Melaleuca preissiana* Tall Open Scrub over Open Herbland/Grassland of mixed herbaceous weeds

Cliff top near barbeque

Acacia rostellifera, *Agonis flexuosa* and *Banksia sessilis* Tall Open Scrub over *Alyxia buxifolia* and *Hakea prostrata* Shrubland over *Melaleuca systema* and *Acanthocarpus preissii*
Low Shrubland over Closed Herbland/Grassland of mixed herbs and annual weeds

River Foreshore

Arundo donax and *Pennisetum setaceum* Closed Grassland

Cliff face

Agonis flexuosa Tall Open Scrub over *Spyridium globulosum* Open Shrubland over Closed Herbland/Grassland of mixed annual weeds

Limestone outcrop (burnt)

Xanthorrhoea preissii Open Shrubland over *Leucopogon parviflorus*, *Dryandra nivea* and *Melaleuca systema* Low Open Shrubland over *Tricoryne elatior* Very Open Herbland over Closed Herbland/Grassland of mixed annual weeds

Limestone outcrop (unburnt)

Acacia rostellifera Tall Open Scrub over *Clematis linearifolia* and mixed annual weeds
Closed Herbland/Grassland

Edge of Limestone outcrop

Agonis flexuosa Tall Shrubland over *Xanthorrhoea preissii* Low Shrubland over Herbland/Grassland or mixed annual weeds

Parkland

Closed Herbland/Grassland of mixed annual weeds

2.4.3 Bushland Condition

The entire site was traversed on foot to determine the bushland condition using the scale of Keighery Scale (1994) as shown in **Table 1** below and **Map 4** in **Appendix One**.

Table 1: Keighery (1994) Bushland condition scale used for mapping

| Condition | Criteria |
|----------------------------|--|
| Pristine | No obvious signs of disturbance. |
| Excellent | Vegetation structure intact, disturbance only affecting individual species and weeds are non-aggressive species. |
| Very Good | Vegetation structure altered, obvious signs of disturbance e.g: repeated fires, aggressive weeds, dieback, logging and grazing. |
| Good | Vegetation structure altered, obvious signs of disturbance. Retains basic vegetation structure or ability to regenerate it. The presence of very aggressive weeds at high density, partial clearing, dieback, logging and grazing. |
| Degraded | Basic vegetation structure severely impacted by disturbance. Requires intensive management. The presence of very aggressive weeds at high density, partial clearing, dieback, logging and grazing. |
| Completely Degraded | Vegetation structure is no longer intact and the area is completely or almost completely without native flora. 'Parkland Cleared'. |

The site was determined overall to be in a *Degraded* condition, although some small patches were in slightly better condition than others. Much of the area is uninterpretable because the

area has been recently burnt. While the burnt area is mapped as degraded its condition rating may be higher once it fully recovers in three to five years.

Weeds were present in greater than 80% ground cover for the majority of the site. Prevalent weeds included *Ehrharta calycina* (Perennial Veldt Grass), *Schinus terebinthifolia* (Japanese Pepper), *Arundo donax* (Giant Reed), *Oxalis pes-caprae*, (Soursob), *Euphorbia terracina* (Geraldton Carnation Weed) and *Lupinus cosentinii* (Lupins). There was some disturbance, such as informal tracks and plantings of exotic plants.

Native understorey species were sparse across the site and almost completely absent in the northern and eastern portion of the reserve. Most of the understorey species were shrubs as the annual herb species would not have been able to compete against the weeds and have disappeared over the years. As a result, there was very little of the original vegetation structure remaining.

Presence of local overstorey species varied across the site.

2.5 Flora

A total of 36 native species were found at the site during two survey periods one in winter 2008 and another in spring 2008 (**Appendix Two**). No rare or priority listed flora were found in the survey. A number of specimens of the species *Boronia alata*, which is the only population on the mainland in the Perth Region, were also found.

A total of 35 weed species were also found at the site. A number of these species are rated as the highly important environmental weeds in the metropolitan area as they have the potential to significantly reduce the ecological values of the bushland.

2.6 Fauna

The original diversity of animal species has inevitably been reduced through activities such as urbanisation and clearing. However, the existing remnants do support a valuable range of species. The study area is known to support habitat for the Rainbow Bee Eater (*Merops ornatus*). This migratory bird is becoming increasingly rare within suburbia and suitable habitat needs to be preserved.

2.7 Recreation and Heritage

The site has important passive recreational values for the local and more regional population of the area. The dual use path is a Regional Recreation Path which is part of the Perth Bicycle Network and provides a link along the river for both cyclist and walkers. The area is regularly used by local for walking, exercising and social interaction. The foreshore is also used for recreational fishing and canoeing.

The cultural values include the cliffs which expose a rich fossiliferous shell bed that was deposited towards the latter part of the Pleistocene Era. The bed is reported to be one of the best preserved and most informative deposits of its age in Western Australia. The cliffs are listed by the National Trusts of WA and are regularly used for teaching purposes.

The site also adjoins the heritage listed aboriginal camp site at Minim Cove (S0183). This site has been ascertained to be over 10,000 years old through carbon dating of aboriginal artefacts found at the site.

3.0 Weed Control Strategy

South Mosman Park Bushland Management Plan

3.1 Introduction

The Weed Control Strategy is aimed at improving knowledge of and identifying weed control methods for key weed species. It is important that weed control measures aimed at reducing the extent of weeds are coupled with improving the condition of bushland. This can be achieved through the preparation of specific weed control plans and ecological restoration plans.

It is also important that any changes made to the weed control strategy are consistent with the planning policies of the Swan River Trust (Swan River Trust 2009). The Swan River Trust (2007) *Development Control Procedures* should be used as a guiding document to ensure the approval requirements of any such changes, in accordance with the Government of Western Australia's (2006) *Swan and Canning Rivers management Act 2006*.

3.1.1 Objectives

The objectives of the weed control strategy are to:

- identify the weed species with the highest priority for control due to their invasive characteristics and threats to remnant bushland
- map the identified high priority weed species
- prevent introduction of additional weed species
- prevent further encroachment of weeds into bushland areas
- minimise any detrimental effects of the weed control programme on the native biota
- integrate the weed control programme with bushland restoration programmes
- set performance targets aimed at demonstrating the effectiveness of control strategies, reductions in weed populations and improvement in bushland condition.

3.1.2 Background

Environmental weeds are plants that establish themselves in natural ecosystems and modify natural processes, resulting in the decline of the communities they invade. Impacts on ecosystem function by environmental weeds include:

- resource competition, as weeds often out-compete native species
- prevention of seedling recruitment of native species
- alteration to geomorphological processes, such as increased erosion
- changes to soil nutrient status
- alteration of fire regime, usually through increased fire frequency
- changes to the abundance of indigenous fauna due to less diverse habitat
- loss of genetic and species diversity
- changes to the structure of vegetation communities, often by the removal of the shrub layer or native ground covers.

Disturbances that contribute to the spread of weeds include:

-
- clearing
 - fire (arson)
 - trampling
 - off-road vehicles
 - rubbish dumping, including soil and garden waste
 - movement of weed seed, especially by vectors along the numerous tracks in the area.

3.2 Prioritising Weeds

3.2.1 Identifying Weeds

A total of 35 weed species were recorded by Ecoscape in winter and spring 2008. Species not identifiable due to the season of survey were named to the most accurate level possible. However, it must be noted that this list is not exhaustive and that additional weed species may be present at different times of the year. **Appendix Three** provides a list of all weeds known to occur on the site.

3.2.2 Weed Significance

The priority rating of each recorded weed species was determined after examining:

- the ratings under the *Environmental Weed Strategy of Western Australia* (EWSWA) (Department of Conservation and Land Management, 1999)
- the ratings under Dixon and Keighery (1995) *Recommended methods to control specific weed species*
- whether it was listed under the *DAFWA Agricultural and Related Resources Protection Act 1976* (ARRPA)
- whether it was listed as a *Weed of National Significance* (WONS) (Weeds Australia 2008).

The role of EWSWA is to highlight which weed species pose significant environmental risk in Western Australia. The EWSWA rating provides a basis for determining which weeds are most critical to control. The three characteristics used for determining the EWSWA rating are:

- *invasiveness* – ability to invade bushland in good to excellent condition, and waterways
- *distribution* – wide current or potential distribution including consideration of known history of wide distribution elsewhere in the world
- *environment impacts* – ability to change the structure, composition and function of ecosystems, in particular to form a monoculture in a vegetation community.

EWSWA weed species were rated accordingly:

- *High* - have all three of the characteristics
- *Moderate* - have two of the characteristics
- *Mild* - have one of the characteristics
- *Low* - not deemed to have any of the characteristics.

The system used by Dixon and Keighery (1995) classified all weeds according to the threat they pose to bushland in the Perth Metropolitan region. The three classifications used were:

- *Priority 1* - major weeds, which are the most serious weeds within their ecosystem, often affecting many reserves or habitats in ways likely to permanently degrade them
- *Priority 2* - nuisance weeds, which are generally found only in a few locations or ecosystems, usually in disturbed areas
- *Priority 3* - minor weeds, which have little known effect and occur in smaller numbers or are less competitive than *Priority 2* weeds.

The type of control for ARRPA declared weed species are listed below:

- *P1* – Prohibits movement of plants or their seeds within the State. This prohibits the movement of contaminated machinery and produce including livestock and feed.
- *P2* – Eradicate infestation to destroy and prevent propagation each year until no plants remain. The infested area must be managed in such a way that prevents the spread of seed or plant parts on or in livestock, fodder, grain, vehicles and/or machinery.
- *P3* - Control infestation in such a way that prevents the spread of seed or plant parts within and from the property on or in livestock, fodder, grain, vehicles and/or machinery. Treat to destroy and prevent seed set all plants.
- *P4* – Prevent the spread of infestation from the property on or in livestock, fodder, grain, vehicles and/or machinery. Treat to destroy and prevent seed set on all plants.

WONS was jointly declared by the Minister for Forestry and Conservation, the Minister for Agriculture, Fisheries and Forestry and the Minister for The Environment in 1999 as part of the *National Weeds Strategy*. The four characteristics used for determining where the species was of national significance were:

- invasiveness
- impacts
- potential for spread
- socioeconomic and environmental values.

3.2.3 Ranking Priority Weeds

Ranking Method

The above sources were used to rank the recorded weed species in order of priority for control. Both EWSWA and Dixon and Keighery (1995) were used because it allowed most weeds identified in the study area to be assigned a rating and thereby ranked. If only one source had been used, many weed species would have not been assigned a rating score.

For the purposes of this study, the Dixon and Keighery (1995) ratings of *Priority 1* and *Priority 2* were considered to be equivalent to the EWSWA ratings of *High* and *Moderate*, respectively. The Dixon and Keighery (1995) rating of *Priority 3* was considered to be equivalent to the EWSWA ratings of *Mild* and *Low*. Species which had only been rated under one system were assumed to have an equal rating in the other system. For example, a species that had a *High* rating in EWSWA but is not rated in Dixon and Keighery (1995) was assumed to have a *Priority 1* rating in Dixon and Keighery (1995).

The use of two rating systems does result in some conflict when assigning a ranking for a weed species. To overcome this issue, a scoring system was developed to enable the ranking of the weed species. The scoring system, is summarised in the **Table 2**, is as follows:

- EWSWA rates were scored as follows: High (3 points), Moderate (2 points) and Mild/Low (1 point). Mild and Low in EWSWA are considered to be equal.
- Dixon and Keighery rates were scored: Priority One (3 points), Priority Two (2 points) and Priority Three (1 point).
- If a weed was not rated by both EWSWA and Dixon and Keighery it was given a score of 1.

Table 2: Calculated rating of priority weeds

| EWSWA Rating | Dixon & Keighery (1995) Rating | Score | Priority |
|--------------|--------------------------------|-------|----------|
| High | Priority 1 | 6 | High |
| High | TBA | | |
| TBA | Priority 1 | | |
| High | Priority 2 | 5 | High |
| Moderate | Priority 1 | | |
| High | Priority 3 | 4 | Moderate |
| Moderate | Priority 2 | | |
| Moderate | TBA | | |
| Mild/Low | Priority 1 | | |
| TBA | Priority 2 | | |
| Moderate | Priority 3 | 3 | Moderate |
| Mild/Low | Priority 2 | | |
| Mild/Low | Priority 3 | 2 | Low |
| Mild/Low | TBA | | |
| TBA | Priority 3 | | |
| TBA | TBA | 1 | Low |

Note: TBA = To Be Assessed (weed species which have not been priority rated)

Any recorded weeds were listed by ARRPA or WONS were automatically given a score of 6 and a *High* priority rating.

Priority Ratings of Weed Species

None of the weeds species were listed by ARRPA or WONS so resulting ranking was only by EWSWA and Dixon and Keighery (1995).

A total of eight weed species had a rating of 5 or above and were classified as *High Priority* weeds. Such species need to have immediate targeted strategies in place. A total of thirteen weed species had a rating of 3 or 4 so are a *Moderate Priority* threats to the natural areas and should be targeted afterwards to enhance the site condition. The remaining fourteen species had a rating of two or less, so are considered *Low Priority* threats. These species should be controlled as part of non-target or site-focused maintenance weed strategies if there are any resources available after controlling the high and moderate threat weeds. A list of the High Priority weeds species is presented in **Table 3** below.

Table 3: High Priority Weeds identified in South Mosman Park Bushland

| Scientific Name | Common Names | Final Rating |
|------------------------------|--------------------------|--------------|
| <i>Avena barbata</i> | Bearded Oat | 5 |
| <i>Cynodon dactylon</i> | Couch | 5 |
| <i>Ehrharta calycina</i> | Perennial Veldt Grass | 6 |
| <i>Euphorbia terracina</i> | Geraldton Carnation Weed | 6 |
| <i>Lagurus ovatus</i> | Hares Tail Grass | 5 |
| <i>Lupinus cosentinii</i> | Western Blue Lupin | 6 |
| <i>Lycium ferocissimum</i> | African Boxthorn | 6 |
| <i>Pelargonium capitatum</i> | Rose Pelargonium | 6 |

Tables indicating the calculation of priority weeds and methods of management are located in **Appendix Three**.

3.3 Weed Mapping

3.3.1 Priority Weed Mapping

The presence and distribution of the high priority weeds were mapped in August 2008. GPS positions were recorded for individual plants and perimeters of populations.

The distributions of most of these weeds are indicated in **Map 5 (Appendix One)**. Hares Tail Grass, Couch and Bearded Oat were not mapped as they were scattered across the site and did not form distinct populations.

3.3.2 Exotic Trees

The site survey in August 2008 recorded the GPS locations of other exotic trees. **Map 5** also displays the distribution of the trees, including *Ricinus communis*, (Castor Oil), *Schinus terebinthifolius* (Japanese Pepper), *Chamelaucium uncinatum* (Geraldton Wax) and *Olea europaea* (Olive Tree).

3.4 Control Methods for Weeds

3.4.1 Overall Approach to Weed Control

Integrated Weed Management

Integrated weed management involves the use of control options which creates a sustainable and effective management system. Reliance on one control process will generally not succeed, for example continual use of herbicide can result in herbicide-resistance development in some weed species. In natural areas integrated weed management involves the use of mechanical, chemical, and biological systems coupled with an appropriate restoration (revegetation) process to increase ecosystem resilience and long-term sustainability.

Action Plan

Mapping vegetation condition in conjunction with weed species distribution and abundance allows the formulation of a weed management action plan. This action plan is based on three methods of control – site-led, species-led and cause-led, and follows a series of guiding principles.

Species-led Control

Generally, it is recommended that species-led control be undertaken prior to site-led control. Priority weed species were placed in this category if they:

- have small populations
- are relatively easy to remove
- have a high potential to spread and therefore become a problem in the future.

High priority weeds that fall into this category include *Ehrharta calycina* (Perennial Veldt Grass), *Lycium ferocissimum* (African Boxthorn) and *Rose Pelargonium* (Pelargonium capitatum).

Site-led Control

Generally, it is recommended that site-led control be undertaken after control of species-led weeds. Weed species were placed in this category if they:

- have wide-spread and well-established populations
- require concentrated and/or long-term efforts to remove
- are highly detrimental to ecological functions of bushland if left unchecked.

High priority weeds that fall into this category include *Avena barbata* (Bearded Oat), *Cynodon dactylon* (Couch), *Euphorbia calycina* (Geraldton Carnation Weed), *Lagurus ovatus* (Hares Tail Grass) and *Lupinus cosentinii* (Western Blue Lupin).

Cause-led Control

If a source or cause of weed infestation can be identified, cause-led control can be used. This is suitable where the cause or source can be eliminated or reduced. An example of this may be where weed species are able to spread from enrichment plantings from adjacent parklands and urban development.

3.4.2 General Weed Control Action Plan

A general Weed Control Action Plan (**Table 4**) was developed, based on the guiding principles outlined previously. It is provided as a general guide for determining the priority for weed control activities.

Table 4: General Weed Control Action Plan

| Priority | General Recommendations |
|--|--|
| Priority 1 Start with species-led control | <p>Species-led control:</p> <ol style="list-style-type: none"> 1. Select weeds for control on a species basis according to time of year and available resources. 2. For each weed species, use bushland condition and weed distribution maps to: <ul style="list-style-type: none"> • Start control efforts in <i>very good-excellent</i> condition bushland • Move to <i>good-fair</i> condition bushland • Move to <i>poor</i> condition bushland <p>The above represents primary weed control. Secondary weed control and long-term monitoring of weed populations will also need to be undertaken.</p> |
| Priority 2 Move to site-led control | <p>Site-led control:</p> <ol style="list-style-type: none"> 1. Select sites suitable for site-based control. 2. Use bushland condition and weed distribution maps to: <ul style="list-style-type: none"> • Start control efforts in <i>very good-excellent</i> condition bushland • Move to <i>good</i> condition bushland • Move to <i>degraded</i> condition bushland <p>Depending on resources and time of year it may be necessary to undertake control of different site-led species, prior to moving to other areas. Again, the above represents primary weed control. Secondary weed control and long-term monitoring of weed populations will also need to be undertaken.</p> |
| Priority 3 Move to cause-led control | <p>Cause-led control:</p> <ol style="list-style-type: none"> 1. Select sites suitable for cause-based control. 2. Use bushland condition and weed distribution maps to: <ul style="list-style-type: none"> • Start control efforts in <i>very good-excellent</i> condition bushland • Move to <i>good</i> condition bushland • Move to <i>degraded</i> condition bushland <p>Again, the above represents primary weed control. Secondary weed control and long-term monitoring of weed populations will also need to be undertaken.</p> |

3.4.3 Control of Non-Priority Weed Species

Weed species which were not included in the list of priority species should not be excluded from control activities on that basis. These species should be included in any weed control programme as species which could be controlled if resources allow, but are not classed as high priority at this stage.

As weed control of priority species progresses, other weed species which previously may not have been rated as highly, may become more important. Therefore, it is important to keep weed control programmes flexible and updated according to monitoring data, to ensure that as bushland condition changes and weed species dominance changes, the control activities are adjusted accordingly.

The priority status of individual weed species should be used as a basis for its control, along with factors such as its abundance and distribution. For example, weed species with a final rating below 5 for control, but which has a limited distribution within the site should be controlled if resources allow, rather than left to spread and become a bigger problem.

In general:

- species with a final rating of 5 or 6 (High Priority) should be targeted first

- species with a final rating of 3 or 4 (Moderate Priority) should be controlled opportunistically if resources allow after targeted control of High Priority Weeds
- species with a final rating of 1 or 2 (Low Priority) should be controlled opportunistically if resources allow after control of Moderate and High Priority Weeds.

However, the situation needs to be assessed in context with which other species are present and what resources are available.

3.4.4 Herbicides

It is necessary that the application of herbicides be in accordance to labelling requirements or the manufacturers Materials Safety Data Sheet (MSDS) and must be undertaken by personnel trained in the use of herbicide chemicals. The application of any herbicide for purposes not specified on the labelling requires an Off-Label Permit from the National Registration Authority in Canberra.

The application of herbicides must also be in accordance with water catchment restrictions. Chemical based weed control strategies in particular must recognise potential adverse impacts on water resources such as lakes, wetlands, streams, rivers and dams. Clearly, significant control measures must be implemented in Public Drinking Water Sources Areas for the water we consume. The Department of Water's *Statewide Policy No.2 Pesticides in Public Drinking Water Sources Areas* (DOW 2000) will provide further advice on this matter. It is available on the net at <http://www.water.wa.gov.au>.

Details of herbicides recommended for controlling weeds in South Mosman Park Bushland are provided in **Appendix Three**.

3.5 Monitoring

3.5.1 Monitoring Criteria

When monitoring the site, the following strategies should be adopted:

- Establish monitoring quadrats in areas subject to weed control programs to record the effectiveness of control methods.
- For site-led control – establish monitoring quadrats and survey and record annually.
- For species-led control – monitor effectiveness of control of discrete weed populations or patches, including presence or absence, and, if present, the degree of new infestation.
- For both control methods – monitor the effectiveness of different control methods used (manual vs. chemical control; spot spray vs. blanket spray; contractor vs. community control). The use of photographs from set points enhances this process.
- For cause-led control – monitor any new species introduced from surrounding residential properties.
- Monitor any change in distribution of the species identified in **Table 3** as potential threats to the remnant bushland.
- Monitor for establishment of new weed species.

3.5.2 Performance Criteria

In order to determine the effectiveness of any weed control programme, there needs to be a method of determining success and ongoing progress. The following performance criteria could be used, based on the monitoring data collected:

- Control/ eradicate at least four priority weed species from the site over the next five years.
- Reduction in the area of priority weed infestations by 10% over 5 years.
- Reduction in the total number of weed species in the by 10% over 5 years.

Although not appropriate as performance criteria, other information can be recorded to assist in an overall view of the effectiveness of weed control activities within the site:

- The number of new weed species recorded – it is expected that, initially, new weed species may be recorded as these species may not have been identifiable at the time of the field survey. Over time, it is anticipated that the number of new species recorded should plateau, and then the total number of weed species decrease.
- Any new infestations of priority species – this information can be used to determine source areas for new infestations, and, assessed against the number of hours spent on its control, allow an analysis of the success of control of particular species.

3.5.3 Frequency of Monitoring

Monitoring of bushland condition is recommended to be undertaken every 1-2 years. This is based on the time it takes to undertake initial weed control and then follow-up weed control to remove plants missed initially. Monitoring bushland condition within the site over a shorter time frame is unlikely to show dramatic changes and could be a waste of resources.

Monitoring of weed quadrats should occur annually, and updating of records (eg updating the database) should occur as often as is practicable. The bushland condition could be remapped after the site has been treated for weeds, which may take several years to achieve, depending on the resources available.

3.5.4 Use of Monitoring Data

Monitoring data is useful not only for determining the success of weed control activities, but also for planning weed control activities from year to year. In order for monitoring data to be useful, it needs to be fed back to the managing agencies. That is, any work undertaken in the field, whether it be actual weeding or monitoring of previous weed control sites, should be fed back into a central management system to ensure efforts are being focussed where they are most needed and to ensure the groups are aware of each others' activities.

Weeds to be mapped annually

Highly invasive weeds with the potential to expand rapidly and are high priorities for control should be mapped each year. This includes:

1. *Avena barbata* (Bearded Oat)
2. *Ferraria crispera* (Black Flag)
3. *Schinus terebinthifolia* (Japanese Pepper)
4. *Pelargonium capitatum* (Pelargonium)
5. *Ehrharta calycina* (Perennial Veldt Grass)

6. *Euphorbia terracina* (Geraldton Carnation Weed)
7. *Pennisetum setaceum* (Fountain Grass)
8. *Raphanus raphanistrum* (Wild Radish)

Weeds to be mapped every 2 years

Moderately invasive weeds with potential to become major problems should be mapped every two years. This includes:

1. *Lycium ferocissimum* (African Boxthorn)
2. *Solanum nigrum* (Nightshade)
3. *Chamelaucium uncinatum* (Geraldton Wax)
4. *Lagurus ovatus* (Hares Tail Grass)
5. *Lupinus cosentinii* (Western Blue Lupin)
6. *Arundo donax* (Giant Reed)
7. *Oxalis pes-caprae* (Soursob)
8. *Agave americana* (Agave)

Weeds to be mapped occasionally

To consolidate knowledge of all weeds within the site, each year two weed species not previously mapped should be mapped. This does not need to be a major undertaking every year as some weeds will have very limited distributions. Weeds with higher priority ratings should be mapped first. No frequency for mapping such weeds is suggested as it would not be expected that all the weeds need be mapped.

3.6 Weed Control Recommendations

Recommendations for weed control of South Mosman Park Bushland are summarised in **Table 5** below.

Table 5: Summary of Weed Control Recommendations for South Mosman Park Bushland

| | RECOMMENDATIONS | PRIORITY | RESPONSIBLE PARTY |
|-----|---|-----------------|--------------------------|
| 3.1 | Use an integrated approach to weed control including herbicides, manual removal and modifying microclimates | HIGH | ToMP |
| 3.2 | Conduct weed control using species led approach followed by site led approach. | HIGH | ToMP |
| 3.3 | Map the distribution of all highly invasive weeds with the potential to expand rapidly each year. | HIGH | ToMP |
| 3.4 | Map the distribution of all moderately invasive weeds with potential to become major problems every two to three years. | MODERATE | ToMP |
| 3.5 | Manage weeds such that the targets are achieved. | HIGH | ToMP |

4.1 Introduction

After weed control has successfully commenced, infilling with native plants is crucial to assist in preventing weed re-emerging. The steps required for revegetation are:

- selecting appropriate species for the general site
- determining areas requiring specific revegetation
- selecting which species suitable for each area
- determining appropriate revegetation methods per area.

The objectives for revegetation are to:

- reinstate indigenous flora and vegetation communities
- ensure that vegetation communities are self-sustaining and are capable of natural regeneration.

It should be noted that any changes made to the revegetation strategy should be consistent with the planning policies of the Swan River Trust (Swan River Trust 2009). The Swan River Trust (2007) *Development Control Procedures* should be used as a guiding document to ensure the approval requirements of any such changes, in accordance with the Government of Western Australia's (2006) *Swan and Canning Rivers management Act 2006*.

4.2 Overall Specifications

4.2.1 Species selection

Ideally the species used in revegetation would consist of the entire suite of plants that naturally occur at the site. This requires a comprehensive species list and the ability to propagate all the species. A list of 36 local species was recorded from the site. Species in this list were then selected if their propagation techniques were known and practical.

Additional species were determined by examining the relevant literature for species which occurred in matching soil and vegetation associations. Appropriate species were chosen as whether they were most likely to have been local and whether they were practical for the revegetation process.

Paths

Types of plant species that are appropriate along the pathways are those that:

- are below 1m in height
- have aesthetic value.

Local species that have aesthetic value and are below 1m height are *Banksia dallanneyi* var. *dallanneyi* (formerly *Dryandra lindleyana*), *Banksia nivea* (formerly *Dryandra nivea*), *Dianella revoluta* var. *divaricata*, *Eremophila glabra*, *Hardenbergia comptoniana*, *Lechenaultia floribunda*, *Lepidosperma squamatum*, *Phyllanthus calycinus* and *Tricoryne elatior*.

Additional species may include *Acacia lasiocarpa*, *Anigozanthos humilis*, *Brachyscome iberidifolia*, *Calothamnus sanguineus*, *Conostylis candicans*, *Ficinia nodosa*, *Grevillea thelemanniana*, *Hemiandra pungens*, *Hovea pungens*, *Hovea trisperma*, *Kennedia prostrata*, *Leucophyta brownii*, *Lechenaultia linarioides*, *Lepidosperma gladiatum*, *Lobelia tenuior*, *Orthrosanthus laxus*, *Petrophile linearis*, *Petrophile serruriae*, *Trachymene coerulea* and *Trymalium ledifolium*.

Restricting access

There are several informal tracks on site that lead down to the foreshore area. Restricting access through revegetation areas is critical to the establishment of seedlings and also safety. This can be achieved through infrastructure such as fences, signs and appropriate formal paths; and by quickly establishing plants that can deter pedestrian access. Such plants need to possess at least two of the following characteristics:

- spiny branches and leaves
- very dense foliage
- medium to large size when mature.

The common name of *Acacia pulchella*, (Prickly Moses), is sufficiently descriptive to indicate why it can be effectively used for blocking access. A similar prickly species is *Acacia lasiocarpa* (Dune Moses) Both are relatively short-lived and therefore should not be the only species planted in large or highly visible areas. Other recommended species with spiny leaves which will deter access to some degree are *Acanthocarpus preissii*, *Banksia sessilis* (Parrot Bush), and *Hakea prostrata* (Harsh Hakea).

Plants that have dense foliage and medium to large size may physically block access without the need of spiny foliage. Such plants include *Acacia cyclops* (Coastal Wattle), *Acacia rostellifera* (Summer Scented Wattle), *Calothamnus quadrifidus* (One Sided Bottlebrush) and *Melaleuca huegelii* (Chenille Honey Myrtle).

4.2.2 Sources of Tubestock and Seeds

Ideally plant material should be sourced from near the site, with no more than one third of the available seed being collected from any individual plant and numerous “parent” plants used. This avoids issues of:

- inbreeding where too few “parents” are used and the seedlings produced lack vigour
- genetic pollution due to the introduction of dissimilar genetic material (from a different area) which can result in sterile plants or a form of a species not native to the site becomes rampant.

However sourcing material nearby maybe quite difficult due to extensive disturbance and/or clearing in the vicinity and there is presently a dearth of information in the public domain with regard to the distances at which genetic variation becomes important for native species.

The precautionary principle needs to be taken in sourcing material as close to Mosman Park as possible and attention given to record keeping and obvious morphological differences between plants occurring onsite and seedlings planted.

4.2.3 Plant Establishment

Direct Seeding

Direct seeding can be a useful technique in the reconstruction areas if weeds can be suppressed to much lower levels than they presently area. Some seed will need to be scarified or heat treated before planting. Areas to be planted should be weed free and the ground lightly tilled to create random furrows approximately 50 mm deep in which the seed can lodge. The seed should be mixed and bulked with an inert material before broadcasting by hand. Application rates for direct seeding should be between 3 and 4 kg/ha, although this will depend on the viability of seeds of individual species. A light cover of mulch (1-2 cm deep) is recommended over the direct seeded areas. Only certified dieback free mulch should be used.

Planting Tubestock

Native seedlings should be planted in late autumn and early winter to ensure good establishment from beneficial winter rains. Seedlings should only be planted after initial rainfall has thoroughly moistened the soil. Seedlings which have grown beyond post-emergent stage (around four to nine months, depending on species growth rates) in square plastic pots (eg 75 x 75 x 100 mm or similar) are considered most suitable for planting. Mature stock, although less suitable, do provide an obvious statement to the general public that a regeneration programme is underway and are useful in some places. If possible, native seedlings should include a range of ground strata, middle strata and upper strata species with a view to achieving the floristic and structural composition of the original vegetation community.

Adequate ground preparation is important for good plant establishment. A small area approximately 50 cm in diameter should be cleared of weeds either by using a weedmat, manual hoeing or herbicides. Thick layers of mulch can deny weed seeds access to light and thereby restrict their growth. Following the application of the manual and herbicide control, weed-free mulch can be spread around revegetated seedlings to help reduce weed growth. Care must be taken in sourcing mulch to ensure that it is not contaminated with weed seeds or disease. It is not necessary to water plants on planting provided they are well watered before planting and the planting precedes good wetting rains.

Plants should preferably be grown from fertile seeds or cuttings collected within the study area or surrounding areas of similar vegetation type. All of the propagated plants should be grown by accredited *Phytophthora*-free nurseries, preferably those specialising in contract growing of revegetation species. No fertilisers should be used at the time of planting as this can harm the seedlings' roots and also promote weed growth. Seedlings should not be staked for support as free standing plants become more durable and strong. Care should be taken that plants are not evenly spaced or planted in rows. Seedlings should be randomly clumped or spaced to achieve a natural effect. Only certified dieback free mulch should be used.

4.3 Specification for Management Zones

Specific species lists need to be constructed according to each area's characteristics. The following are descriptions of different management zones located throughout the site, their

characteristics and types of appropriate species required for revegetation. Plant species shall be considered for selection for each of the zone if plants:

- already occur in or immediately adjacent to the zone
- can survive in the site conditions (eg compete against re-emerging weeds)
- may improve the bushland condition of the zone.

A total of five zones were determined to require separate revegetation treatments (**Table 4**).

Table 6: Extent of Five Management Zones

| Zone Number | Zone Name | Extent (m ²) |
|--------------|--|--------------------------|
| 1 | Heath on shallow Limestone | 7,546 |
| 2 | Tuart/Peppermint Woodland | 9,485 |
| 3 | Parkland/Tuart/Peppermint Woodland | 4,650 |
| 4 | Low Woodland of Peppermint/Sheoak | 2,844 |
| 5 | Riverine Flat of low shrubs and mixed sedges | 3,690 |
| Total | | 28,215 |

Species lists for each particular area that may be used in the revegetation strategy is located in **Appendix Two** with the rationale for selecting appropriate species for each area discussed below.

The boundaries of the five zones are indicated in **Maps 6, 7 and 8** in **Appendix One**.

4.3.1 Zone 1 – Heath on shallow Limestone

This community has been recently severely impacted by fire and the recruitment suffering through increased competition with aggressive weed species. The aim here is to restore the heath vegetation through both weed control and revegetation. Species which are low growing will be used.

4.3.2 Zone 2 – Tuart/Peppermint Woodland

This zone is proposed to be restored with a mixture of low growing and taller species. The low growing species are proposed for the edges along the path to help with managing visibility for park user safety whilst the taller trees are proposed for areas adjacent existing bushland to consolidate and build the resilience of the bushland.

4.3.3 Zone 3 - Parkland/Tuart/Peppermint Woodland

The vegetation that would have occurred in this area and to the east has been modified through parkland clearing and replacement with non-local species. The deeper soils permit the establishment of taller tree species such as the Tuart and Peppermint. This community should be properly restored so that the entire South Mosman Park Bushland has all the communities representative of those that originally occurred in the Minim Cove area.

4.3.4 Zone 4 – Low Woodland of Peppermint/ Sheoak

This area is generally in good condition and needs additional species to infill gaps that occur in the existing vegetation.

4.3.5 Zone 5 – Riverine Flat of Low Shrubs and Mixed Sedges

The low riverine area adjacent to the river requires the removal of weeds particularly Giant Reed (*Arundo donax*) and Feathertail Grass (*Pennisetum setaceum*) which dominates the area. A low woodland dominated by *Casuarina obesa* and other species is proposed for the

area. Sedges are proposed along the immediate foreshore which will contribute to foreshore stabilisation and filtering of nutrients.

Recommendations for revegetating South Mosman Park Bushland is summarised in **Table 7** below.

Table 7: Summary of recommendations for revegetation at South Mosman Park Bushland

| | RECOMMENDATIONS | PRIORITY | RESPONSIBLE PARTY |
|-----|---|-----------------|--------------------------|
| 4.1 | Use only plant species for rehabilitation if they would have naturally occurred at the sites. | HIGH | ToMP |
| 4.2 | Only use certified dieback free mulch | HIGH | ToMP |
| 4.3 | Continue to compile a comprehensive list of species present. | MEDIUM | ToMP |
| 4.4 | Use only forms of plants that would have naturally occurred onsite. | HIGH | ToMP |
| 4.5 | Document all rehabilitation undertaken including weed control and tree planting. | HIGH | ToMP |
| 4.6 | Establish a monitoring program for indigenous species, with the location and abundance of species in very low abundance recorded. | LOW | ToMP |

5.0 Fauna Monitoring Strategy

South Mosman Park Bushland Management Plan

5.1 Introduction

Native fauna form an important component of South Mosman Park Bushland. It is expected that the numbers and diversity of native fauna should increase as the site is rehabilitated. Surveying the occurrence of fauna can then act as a key indicator of rehabilitation success and help direct further management strategies.

5.1.1 Objective

The objective of the fauna monitoring is to:

- determine any increase in fauna occurrence as a result of rehabilitating the site.

5.2 Strategy

A baseline fauna survey should be conducted prior to any rehabilitation works. The survey should determine what native fauna species currently inhabit or use the site as well as an estimate of their abundance.

Further fauna surveys should be done at appropriate times to note any changes in fauna abundance and diversity. An increase over time will indicate success of rehabilitation whereas if no change or a decrease will indicate potential failure. The observed changes in native fauna occurrence may then direct further rehabilitation and management strategies.

All surveys should follow the standards set by the Environmental Protection Authority (2004) *Guidance Statement No. 56 – Terrestrial Fauna Surveys*.

5.3 Fauna Monitoring Strategy Recommendations

Recommendations for fire management at South Mosman Park Bushland is summarised in **Table 8** below.

Table 8: Summary of recommendations for fauna monitoring at South Mosman Park Bushland

| | RECOMMENDATIONS | PRIORITY | RESPONSIBLE PARTY |
|-----|--|----------|-------------------|
| 5.1 | Conduct a baseline survey of native fauna diversity and abundance prior to any rehabilitation works | HIGH | ToMP |
| 5.2 | Conduct regular fauna assessments to note any changes and adjust management strategies accordingly to continue to improve native fauna diversity and abundance | HIGH | ToMP |

6.0 Fire Management Strategy

South Mosman Park Bushland Management Plan

6.1 Introduction

Fires have the potential to destroy the native ecology, both directly through burning the vegetation and indirectly, such as allowing weed invasion. It also threatens human life and adjacent properties. A strategy is therefore required to minimise the risk and impact of fire on South Mosman Park Bushland.

A Fire Management Strategy has been set out below, outlining plans and strategies to reduce fire hazards. The aim of this plan is to define fire management and fire response strategies that are consistent with each other, and conserve existing remnant bushland and flora/fauna habitat of South Mosman Park. Specific aims are to:

- protect lives, properties and assets
- preserve conservation values of the reserve
- maintain the risk posed by wildfire to adjoining property at an acceptable level
- preserve ecological and evolutionary processes
- conduct the monitoring necessary to ensure that the four above aims are achieved.

Any changes made to the fire management strategy should be consistent with the planning policies of the Swan River Trust (Swan River Trust 2009). The Swan River Trust (2007) *Development Control Procedures* should be used as a guiding document to ensure the approval requirements of any such changes, in accordance with the Government of Western Australia's (2006) *Swan and Canning Rivers management Act 2006*.

6.1.1 Objectives

The purpose of the fire management strategy is to minimise the risk of fires within the bushland and minimise the spread, damage and danger of any fire that does occur. A further aim is to minimise adverse environmental impacts of any fires that do occur.

The objectives for fire management are to ensure protection of:

- human life
- property
- ecological integrity and biological values.

There is no single optimal fire regime for balancing all these requirements and fire management must always consider local conditions.

6.1.2 Background

General Impacts of Fires on the Biological Environment

Both the immediate and cumulative impacts of fires on biological values are of major concern. Fires can impact upon the natural vegetation in a number of ways including:

- promotion of weed growth

- alteration of species composition
- threaten the viability of rare, endangered or geographically restricted species
- threaten the viability of obligate seeder species (which can not resprout).

Fires at intervals more frequent than the inherent regenerative capacity of the vegetation can promote the spread of exotic weeds by creating the required conditions, including:

- increased light penetration through burnt-out overstorey
- reduced competition from native perennial species
- increased availability of nutrients.

Increased weed growth, particularly annual grassy weeds, greatly increases the fire risk in a number of interrelated ways, including:

- forming a fine-textured fuel which is highly flammable
- producing a high fuel load annually depending on climate and growth rate. Native plants take much longer to reach the same fuel levels
- forming a continuous fuel bed, permitting a fire to spread quickly (native plants usually have gaps between them which act to slow down the spread of fire)
- creating a very hot fire at ground level.

This situation leads to a cycle of increased weed growth leading to increased fire risk and thus increased fire intensity and frequency, which in turn lead to increased weed growth. The effect this situation has on natural communities is profound and can quickly lead to a greatly reduced diversity of flora and fauna.

Although fire is a natural part of the ecology of the study area, the current environmental conditions are very different to the natural situation, due to a number of interrelated changes, including:

- the isolated nature of the remnant vegetation within an urban context
- the greatly increased risk of fire ignition due to arson.

Fire History and Ignition Risk

The bushland has been subjected to fires in the last 50 years. The last fire was in the summer of 2006/7 which affected the area to the north of the dual use path.

6.1.3 Strategy

The proposed fire management plan has 3 core elements:

- hazard reduction
- fire suppression
- post-fire recovery and incident analysis.

The purpose of the fire management plan is to reduce the frequency of ignitions, either accidental or deliberate, and minimise the extent of fires within the bushland. A further aim is to minimise adverse environmental impacts of any fires that do occur.

Hazard Reduction

Hazard reduction involves fuel and ignition reduction.

Fuel Reduction

Strategic Burns

Strategic or controlled burns in urban bushland such as South Mosman Park Bushland are **not** recommended. This recommendation is also supported by a range of evidence, some of which is summarised below.

Controlled burns have been discontinued in Kings Park, which contains approximately 270 ha of bushland in the centre of Perth, because it was considered counterproductive. A comparison of the prescribed block burning program in Kings Park (1954 – 1962) with later fire suppression regimes revealed that the area burnt by wildfire did not vary significantly but that the total area burnt decreased dramatically when prescribed burns were not conducted (Dixon et al 1995).

It was also found that Kings Park would have to be burnt every 3 to 4 years to ensure fuel levels are kept below 8 tonnes per hectare, and burning at this frequency has been shown to exacerbate the fire hazard by facilitating the replacement of native understorey with grass weeds such as Veldt Grass (Dixon et al 1995).

As a general rule regular frequent burning can lead to the increase of short-lived herbs and some grasses at the expense of obligate-seeding species (ie species which do not resprout).

Low Fuel Sites

South Mosman Park Bushland has extensive areas of low fuel zones in the form of parkland areas and playing fields. There is limited risk to houses adjacent the site as they are separated by a road from the bushland.

In the bushland areas the most effective manner in which fuel loads can be minimised throughout the bushland is to reduce the abundance of exotic grasses such as Veldt Grass and other grass weeds, and this will also benefit the native species that can be out competed by these weeds.

The bushland is also dissected by a dual use path which serves as:

- a low fuel buffer area preventing the spread of low and moderate intensity fires
- an access trail for fire suppression vehicles.

Ignition Reduction

A significant portion of fires in urban bushland are intentionally lit. Over a 50 year period in Kings Park, 48% of fires are known to be due to arson. As arson is difficult to police education is a worthwhile option for reducing fires.

Interpretative signs within the study area could be installed which make reference to the dangers of wildfires to human life and property, and the destructive cumulative effects of frequent fire on flora and fauna. The message should focus on the risk of accidental fire lighting and the need for the public to be vigilant against arsonists. Education programmes should also include the importance and vulnerability of the flora and fauna of the reserve, methods of preventing wildfire, controlling their spread and ensuring human safety in the event of a major fire within the reserve.

Fire Suppression

Fire suppression involves fire-fighting application once a fire has started and taken hold.

The Fire and Emergency Services Authority is the peak fire fighting body in Western Australia. The Authority administers the: *Fire and Emergency Services Authority of Western Australia Act 1998*; *Fire Brigades Act 1942*; *Bush Fires Act 1954*; and *Emergency Services Levy Act 2002* (FESA, 2003).

Fire suppression can only be effective if fires are detected quickly and fire fighters can respond and access the fire and contain it before it becomes uncontrollable. The nearest fire station is:

Fremantle Fire Station
Phillimore Street FREMANTLE

Post-fire Recovery and Incident Analysis

Bushland is in a highly sensitive condition following fire. The soil is left bare and sensitive to erosive processes, such as vehicle and foot movements, heavy summer rain and wind. Therefore, following a bushfire within the study area access to any burnt areas should be limited to management purposes in the first six to twelve months.

Fire fighting operations have the potential to cause mechanical damage through trampling of vegetation, water erosion and small scale clearing. This cannot be entirely avoided, though should be minimised where possible through appropriate training within the fire-fighting authorities. Trained bush regenerators should carry out reparation of mechanical damage.

Following fire, weed species have an opportunity to increase in density and abundance. Weed control measures will need to be implemented if a fire occurs. The post-fire environment is susceptible to further damage, and weed control works should be undertaken at a time that will give the bushland the greatest chance of successful regeneration. Weed control should therefore be revised after each fire.

Post-fire incident analysis is an important facet of fire management which enables fire fighters and fire control authorities to review procedures, strategies and tactics and revise them in light of experience. All fires that occur within the bushland should be recorded. Information that should be compiled includes the date, season, time, cause of ignition, intensity and extent of the fire, fire control methods used and damage caused by the fire. This information can be used for long-term fire management planning.

6.2 Fire Management Strategy Recommendations

Recommendations for fire management at South Mosman Park Bushland is summarised in **Table 9** below.

Table 9: Summary of recommendations for fire management at South Mosman Park Bushland

| RECOMMENDATIONS | | PRIORITY | RESPONSIBLE PARTY |
|-----------------|---|----------|-------------------|
| 6.1 | A ban all open fires at all times should be instigated within the study area. | HIGH | ToMP |
| 6.2 | Reduce fuel ignition risks through control of weeds such as Perennial Veldt Grass. | MODERATE | ToMP |
| 6.3 | Suppress and contain any wildfires within the study area as quickly as possible. | HIGH | ToMP |
| 6.4 | Document fire history with the extent of fires mapped, and dates and causes recorded. | LOW | ToMP |
| 6.5 | Control access into burnt areas as soon as possible after the fire. Access to any burnt areas should be limited to management vehicles only for the first six to twelve months. Seed germination and resprouting of vegetation or regeneration should be monitored for a year following fire. | HIGH | ToMP |
| 6.6 | Revise weed control works after any fires to ensure potential damage by works are minimised and efficiencies are maximised. | HIGH | ToMP |
| 6.7 | Access tracks to be modified to better suit fire fighting vehicles | MODERATE | ToMP |

7.0 Access Strategy

South Mosman Park Bushland Management Plan

7.1.1 Introduction

Primary access to the bushland is via dual use paths which include a Regional Recreation Path. Other minor tracks have been created by people wishing to access the foreshore. These descend over steep unstable limestone cliffs and have the potential to erode during large storm events. The bushland is largely accessible to pedestrians however not to vehicles as barriers restrict access for all vehicles except service vehicles.

All infrastructure discussed below are presented in **Map 7** in **Appendix One**.

It should be noted that any changes made to the access strategy are to be consistent with the planning policies of the Swan River Trust (Swan River Trust 2009). The Swan River Trust (2007) *Development Control Procedures* should be used as a guiding document to ensure the approval requirements of any such changes, in accordance with the Government of Western Australia's (2006) *Swan and Canning Rivers management Act 2006*.

7.1.2 Objectives

The objectives for maintaining, rationalising or upgrading access within the bushland are to provide access for:

- the public's use of the bushland
- Council and community works programs and fire fighting.

These objectives need to be implemented with consideration to construction and maintenance costs.

7.1.3 Path Network

The main path is a dual use path which connects South Mosman Park to the regional recreation path which runs parallel to the foreshore. One major and a couple of minor bush tracks traverse the bushland from the cliff top to the foreshore. The tracks to the foreshore will require rationalisation to meet safety requirements and to provide safe passage for Council workers and community volunteers.

Fences

There are no fences around South Mosman Park Bushland. The only barriers limiting vehicle access to the reserve are along Fairbairn Street. There is also an inconsistent low post and rail fence near the cliffs edge which provides some indication of access restrictions, however it has limitation in restricting access.

7.1.4 Strategy

Path Network and Fences

The existing dual use path system is appropriate and adequate in providing access to and through the bushland reserve. The main change proposed is to modify the alignment of the regional recreation path where it intersects with the dual use path off South Mosman Park.

An investigation of the existing tracks from cliff top to the foreshore will need to be undertaken to determine the most appropriate pathway which will provide safe access to the foreshore. Specialist advice should be sought to determine the hazards and risks of the proposed path alignment.

No additional permanent fencing should be constructed around the bushland area, however temporary fencing may be required as part of weed control and revegetation programmes.

7.2 Access Strategy Recommendations

Recommendations for access to South Mosman Park Bushland is summarised in **Table 10** below.

Table 10: Summary of recommendations for accessing South Mosman Park Bushland

| | RECOMMENDATIONS | PRIORITY | RESPONSIBLE PARTY |
|-----|---|-----------------|--------------------------|
| | ACCESS | | |
| 7.1 | Install temporary fencing to restrict access in those areas where weed control and revegetation are being undertaken. | HIGH | ToMP |
| 7.2 | Investigate the development of a track from cliff top level to the foreshore which manages risk and minimizes impacts on the cliff and natural environment. | MODERATE | ToMP |
| 7.3 | Realign part of the existing dual use path so that the integration of the bushland is enhanced. | MODERATE | ToMP |

8.0 Community Involvement Strategy

South Mosman Park Bushland Management Plan

8.1.1 Objectives

The objectives for community involvement are to:

- demonstrate sound environmental practices to the community
- empower the community to provide and preserve their unique environment for future generations.

8.1.2 Background

The local community have registered an interest in forming a Friends group to management the native vegetation and habitat at South Mosman Park Bushland. The proposed Friends should work closely with the Town of Mosman Park and assist with the implementation of the Management Plan.

The Friends could focus on the following objectives:

- Remove introduced plants and revegetating with indigenous species.
- Encourage the well-being of indigenous flora and fauna.
- Represent the viewpoints of those in the community who wish to preserve and regenerate the natural areas of the Reserve for future generations.
- Increase public appreciation of the area through environmental awareness.

Projects the Friends group could be involved with include:

- planting seedlings
- weeding at focal sites
- weeding targeted species
- mapping weed populations
- contributing to flora and fauna inventories for the site
- assisting with education and interpretation
- writing grant submissions.

8.1.3 Strategy

Generally community-based groups should be encouraged to provide assistance with focused projects, such as specific sites or weeds within a reserve, while the Municipality bears the burden of broader responsibilities (such as control of extensive weeds through spraying programs).

The community projects need to be sufficiently focused such that visible results are obtainable. A sense of on-going ownership is also important and the development of specific rehabilitation sites can facilitate this, with the community group participating in follow-up weeding after planting the same site.

It is important that community volunteers groups be trained in bush regeneration techniques and related topics prior to undertaking works in the bushland. An introductory course in bush regeneration is available from Apace Aid Inc in North Fremantle. Ongoing training should also be offered to volunteers, as well as Mosman Parks park and gardens staff, to ensure all involved parties are informed and skilled in bush regeneration.

8.2 Community Involvement Recommendations

One recommendation for community involvement is presented in **Table 11** below.

Table 11: Summary of recommendations for community involvement in South Mosman Park Bushland

| | RECOMMENDATIONS | PRIORITY | RESPONSIBLE PARTY |
|-----|---|----------|-------------------|
| 8.1 | Continue to support the activities of community involvement through assistance with training and equipment | HIGH | ToMP |
| 8.2 | Offer on-going training in bush regeneration and other related topics for volunteers and Mosman Park parks and gardens staff. | HIGH | ToMP |

9.0 Interpretation & Education Strategy

South Mosman Park Bushland Management Plan

9.1.1 Objectives

The objectives for interpretation and education to help protect the natural and cultural heritage values are to:

- identify, encourage respect for, and preserve Aboriginal and European cultural heritage
- develop opportunities for recreation with minimal impact on the environment
- develop opportunities for increasing community awareness and appreciation of the site.

9.1.2 Background

At present there is little interpretive material associated with the site. The main interpretation is for the Rainbow Bee Eater to inform the public of its presence and to keep dogs on a lead.

The site contains rich natural, Aboriginal and European cultural values including a species of plant that has limited mainland presence (*Boronia alata*), an adjacent Aboriginal site, fascinating geological shell deposits and an association with early European settlement of the Fremantle region.

There is capacity to help the public appreciate the values of the site and thereby contribute to its conservation values.

9.1.3 Strategy

Shelter

The opportunities to inform and inspire the public are not fully realised and the existing shelters could be used for this purpose. This could be created through permanent panel (with information that need not be changed frequently such as a map and the values of the bushland) as well as a panel that can be periodically updated with information (such as the activities of the Council).

Subjects for Interpretation

Interpretation involves translating ideas and concepts into a format that can help people understand more about a place and can increase appreciation of an area.

Interpretation helps to meet the demand for educational visitor experiences and encourages people to care about the places they visit. It should build on the experiences, and interests of the area, in order to enhance an understanding and enjoyment of the place.

It is recommended that interpretation should be based around a theme, as this provides continuity in the stories which reinforces people's memories of the facts and stories presented. In a bushland setting the subjects for interpretation may include:

- Aboriginal and European activities within the site

- geological feature such as the shell beds
- flora and vegetation (eg patterns in the distributions of plant species across a site)
- fauna
- the dynamics of the bushland (eg the relationship between fire and vegetation type, how human activities have degraded the bushland and how it is recovering).

It is important to provide experiences that are interesting and meaningful to visitors by enabling visitors to make connections between their own experiences and those presented, providing an understanding about the meaning and significance within a place. One method for engaging visitors is to pose a question that can be answered in a succinct manner using examples. One example would be:

- The South-western Spiny-Tailed Gecko (*Strophurus spinigerus*) is the only local species capable of squirting harmless, mildly odorous fluid from pores along the top of its tail. This fluid is believed to deter predators.

There are also many examples of such information relating to plants in Robert Powell's excellent '*Leaf and Branch – Trees and Tall Shrubs of Perth*' (Powell 1990).

Other Forms for Presenting Information

The Town of Mosman Park could provide information on South Mosman Park Bushland on the internet.

9.2 Interpretation and Education Strategy Recommendations

Recommendations for interpretation and education at South Mosman Park Bushland are summarised in **Table 12** below.

Table 12: Summary of recommendations for interpretation and education at South Mosman Park Bushland

| | RECOMMENDATIONS | PRIORITY | RESPONSIBLE PARTY |
|-----|--|-----------------|--------------------------|
| 9.1 | Install appropriate interpretive material within the existing shelter. | MODERATE | ToMP |
| 9.2 | Install other signage that helps interpret the values of the bushland and its management at the start of the dual use path at South Mosman Park. | LOW | ToMP |
| 9.3 | Interpretation should be based around a theme. | LOW | ToMP |

10.0 Indicative Costs

South Mosman Park Bushland Management Plan

10.1 Introduction

Significant funding is required for the enhancement and maintenance of the bushland at South Mosman Park Reserve. Estimates of the costs for implementing the works recommended in this plan are given in **Table 12** below. The costs in the tables are intended as a guide only as they can vary considerably, depending on how much work is completed by Town Staff and the details of implementation.

10.2 Weed control and revegetation costs

10.2.1 Opinion of Probable Cost for Restoring Bushland to Very Good Condition

An Opinion of Probable Cost (OPC) for maintaining *Very Good – Excellent* condition and improving *Degraded* condition urban bushland to *Very Good – Excellent* over a five year period are given in **Table 13**.

Table 13: OPC of professional revegetation at South Mosman Park Bushland Reserve

| Stage | Cost \$/ sq m | Limestone outcrop | Low Woodland | Parkland | Cliff top & slope | River foreshore | TOTAL |
|------------------------|------------------|----------------------|-----------------|----------|----------------------|--------------------|------------------|
| Zone | | 1 | 2 | 3 | 4 | 5 | |
| Size (m ²) | | 7,546 | 9,485 | 4,650 | 2,844 | 3,690 | 28,215 |
| Establishment | \$6.00 | \$45,276 | \$56,910 | \$27,900 | \$17,064 | \$22,140 | \$169,290 |
| After 1st Year | \$3.00 | \$22,638 | \$28,455 | \$13,950 | \$8,532 | \$11,070 | \$84,645 |
| After 2nd Year | \$1.20 | \$9,055 | \$11,382 | \$5,580 | \$3,412.80 | \$4,428 | \$33,858.0 |
| After 3rd Year | \$0.50 | \$3,773 | \$4,742.50 | \$2,325 | \$1,422 | \$1,845 | \$14,107.5 |
| Years thereafter | \$0.02 | \$151 | \$189.70 | \$93 | \$56.90 | \$73.80 | \$564.3 |
| TOTAL | | \$76,969 | \$96,747 | \$47,430 | \$29,009 | \$37,638 | \$287,793 |

This OPC is based on the full commercial costs of restoring bushland in an urban setting and it is assumed that seedlings will be bought at a cost of approximately \$1.50 each and that two to three seedlings will be planted per square metre for all zones.

Once the bushland is in excellent condition, the annual maintenance costs should stabilise at approximately \$0.02/sq m. The cost of restoration is higher than maintenance because costs of propagules such as seedlings do not have to be borne.

Costs can be significantly reduced with the use of staff and volunteer labour, particularly in maintenance of higher quality bushland where a greater proportion of costs are labour. Costs can also be reduced by extending works over a greater period of time by staggering revegetation within the site.

References

South Mosman Park Bushland Management Plan

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Appendix One: Maps

South Mosman Park Bushland Management Plan



- legend**
- - - South Mosman Park Bushland
 - Roads
 - Main roads
 - Highways
 - Parkland
 - +— Railway Line

South Mosman Park Bushland Management Plan
Regional Context

Map 1

April 2009





Town of Mosman Park

Not to Scale (This Plan is Diagrammatic Only)
 Project No. 2062-08





Legend

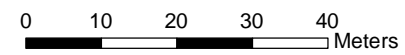
-  Study Boundary
-  Cadastral Boundaries (Landgate, 2005)

Map 2

South Mosman Park Bushland Management Plan
Study site

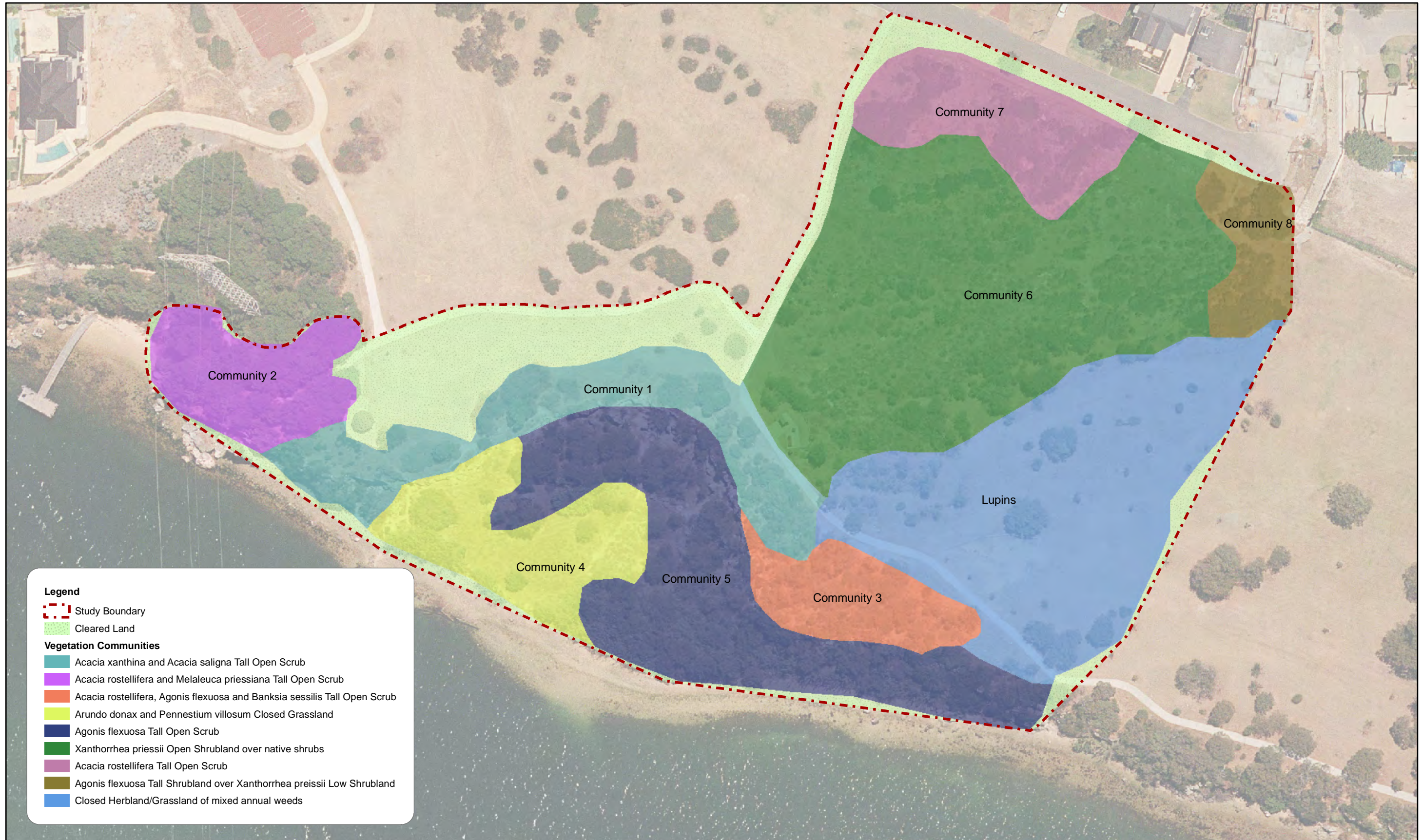
Oct 2008

prepared for the TOWN OF MOSMAN PARK



1:1,000 @ A3
 Project No. 2062-08



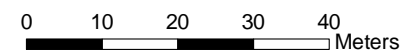


Map 3

**South Mosman Park Bushland Management Plan
Vegetation Communities**

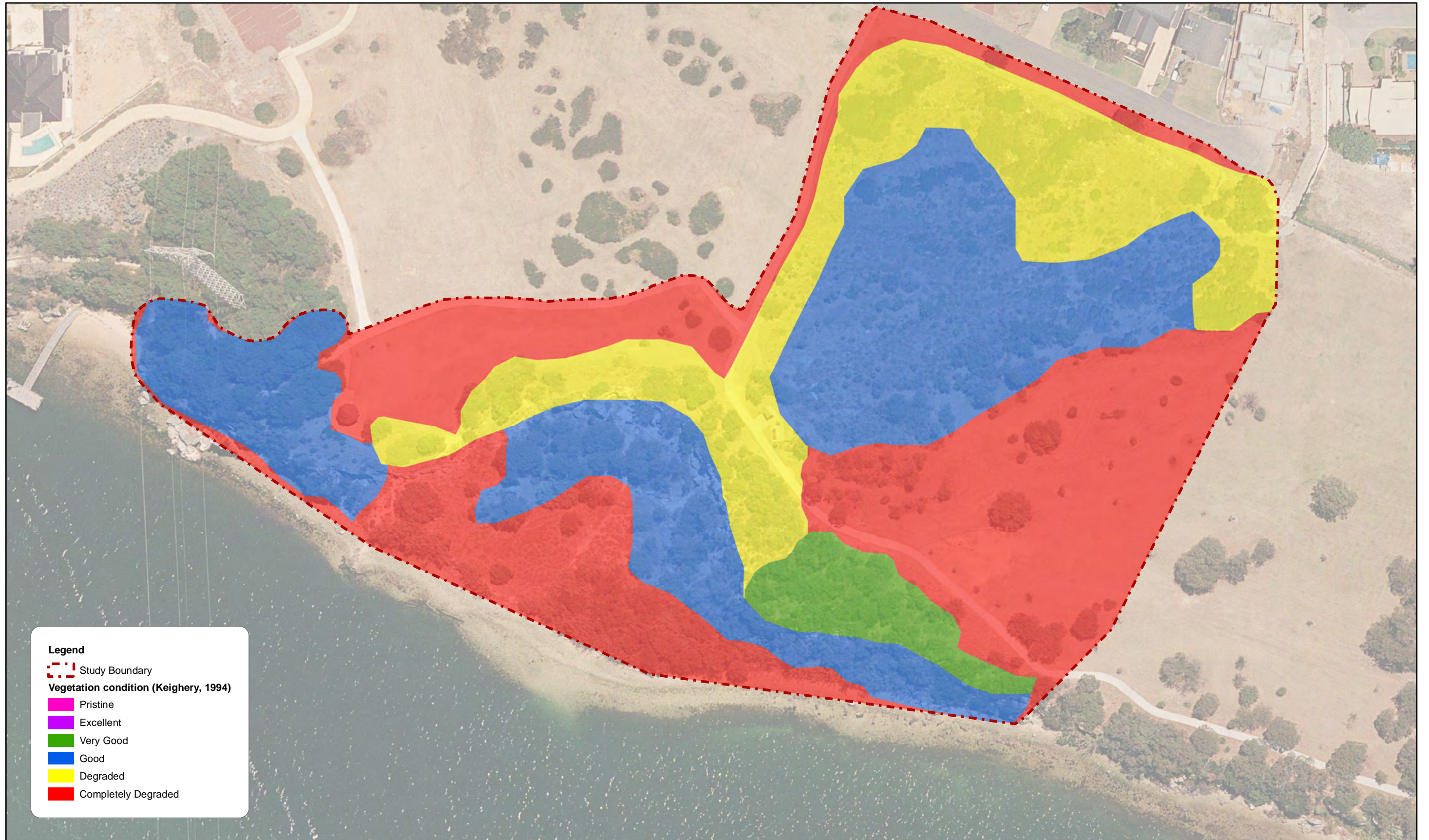
April 2009

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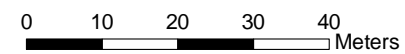
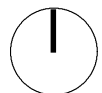


Map 4

**South Mosman Park Bushland Management Plan
Vegetation Condition**

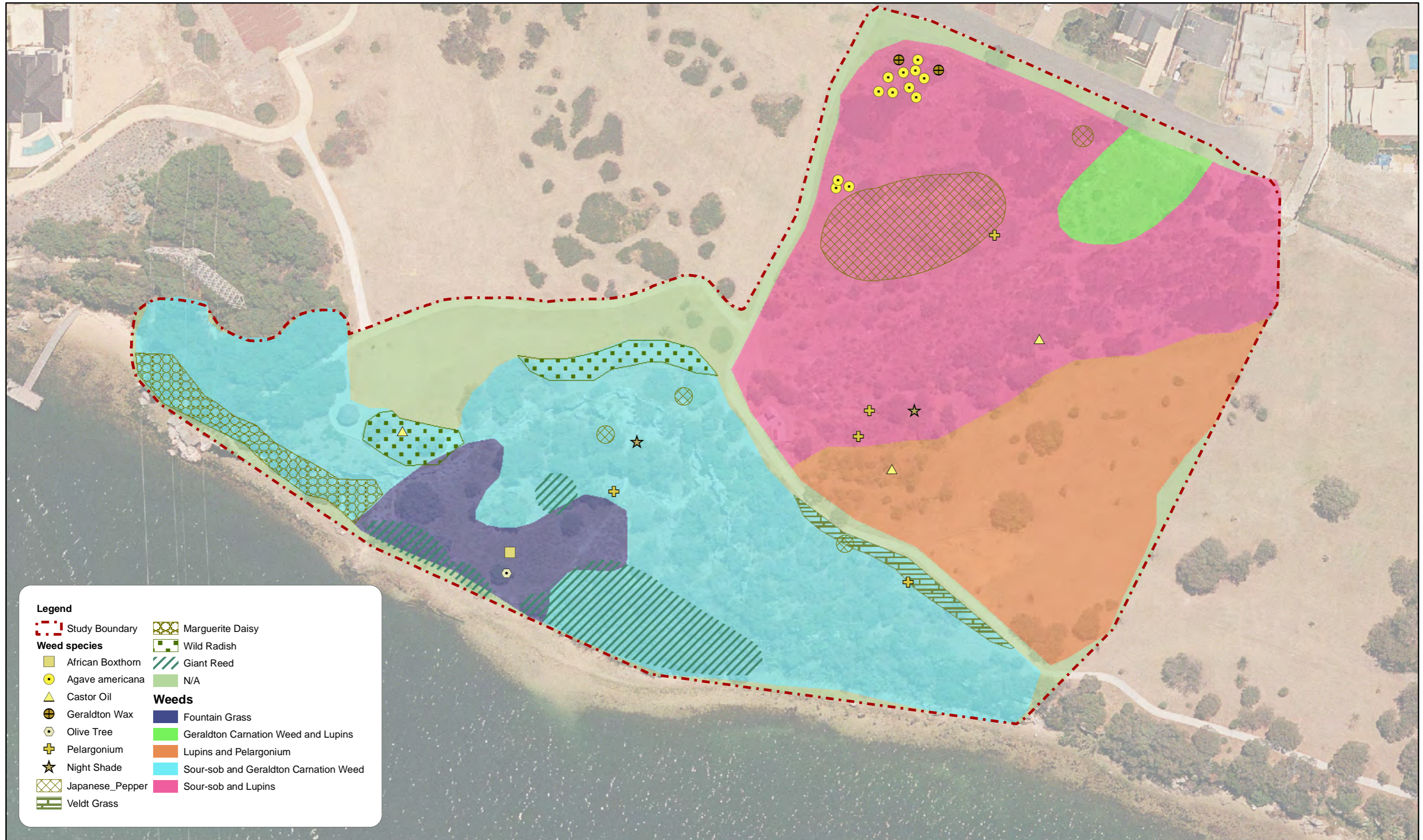
April 2009

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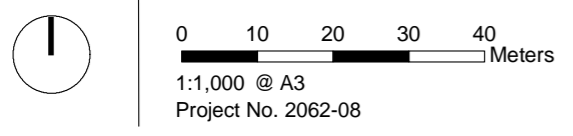


Legend

| | |
|---------------------|---------------------------------------|
| Study Boundary | Marguerite Daisy |
| Weed species | Wild Radish |
| African Boxthorn | Giant Reed |
| Agave americana | N/A |
| Castor Oil | Weeds |
| Geraldton Wax | Fountain Grass |
| Olive Tree | Geraldton Carnation Weed and Lupins |
| Pelargonium | Lupins and Pelargonium |
| Night Shade | Sour-sob and Geraldton Carnation Weed |
| Japanese_Pepper | Sour-sob and Lupins |
| Veldt Grass | |

Map 5 *South Mosman Park Bushland Management Plan*
Weed Distribution

April 2009 prepared for the TOWN OF MOSMAN PARK



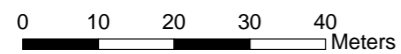


Map 6

**South Mosman Park Bushland Management Plan
Rehabilitation Zones**

April 2009

prepared for the TOWN OF MOSMAN PARK



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Project No. 2062-08



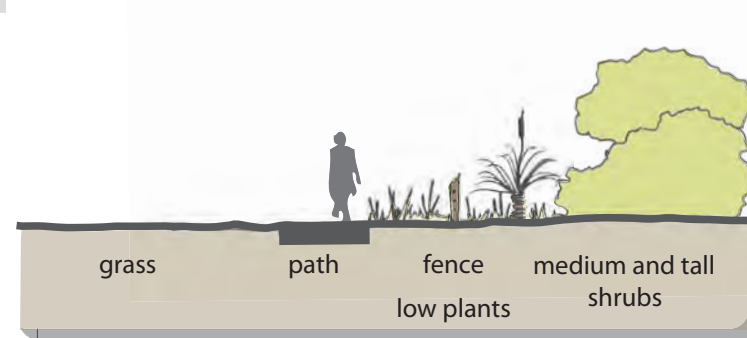


- legend**
- Site Boundary
 - 1m Contours
 - 5m Contours
 - Existing Path
 - Existing Path to be Removed
 - Proposed Path
 - Proposed Temporary Fencing
 - Views to be retained
 - Gazebo
 - Park Bench
 - Existing BBQ + Picnic Area
 - Retained Grassland

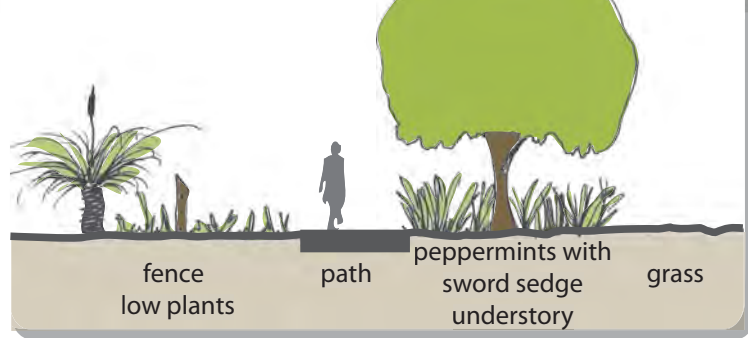
- rehabilitation zones**
- Zone 1 - Heath on Shallow Limestone Soils**
 - species less than 1.5m tall
 - species of mixed height
 - Zone 2 - Tuart / Peppermint Woodland**
 - species less than 1.5m tall
 - species of mixed height
 - Zone 3 - Tuart / Peppermint Woodland**
 - species less than 1.5m tall
 - species of mixed height
 - Zone 4 - Cliff Top Shrubland**
 - species less than 1.5m tall
 - species of mixed height
 - Zone 5 - Low Riverine Woodland with Sedges**
 - species less than 1.5m tall
 - species of mixed height

- trees to provide character**
- Sheoak (*Allocasuarina fraseriana*)
 - to provide structure to the proposed path
 - Peppermint (*Agonis flexuosa*)
 - planted with a Sword Sedge (*Lepidosperma gladiatum*) understory
 - to provide a shady character and structure to the proposed path
 - Quandong (*Santalum acuminatum*)
 - indigenous fruit trees to characterise barbeque area

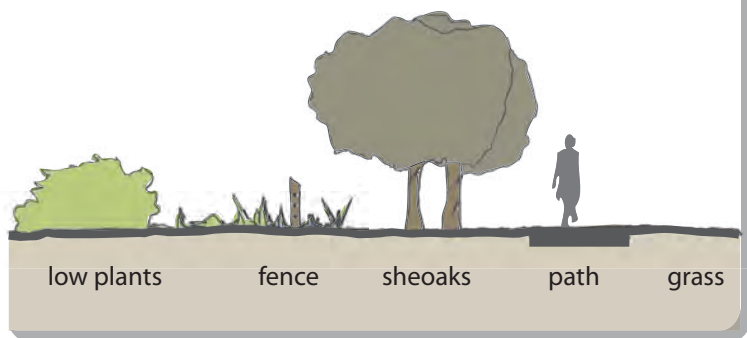
Section A - Open Path Character



Section B - Peppermint Path character



Section C - Sheoak Path Character



South Mosman Park Bushland Management Plan
Rehabilitation Concept Plan

Appendix Two: Native Plants

South Mosman Park Bushland Management Plan

Table 14: Native Flora Inventory of South Mosman Park Bushland

| Scientific Name | Common Name |
|---|-----------------------------|
| <i>Acacia cyclops</i> | Coastal Wattle |
| <i>Acacia rostellifera</i> | Summer Scented Wattle |
| <i>Acacia saligna</i> | Orange Wattle |
| <i>Acacia xanthina</i> | White Stemmed Wattle |
| <i>Acanthocarpus preissii</i> | |
| <i>Agonis flexuosa</i> | Peppermint |
| <i>Alyxia buxifolia</i> | Dysentery Bush |
| <i>Banksia dallanneyi</i> | |
| <i>Banksia sessilis</i> | Parrot Bush |
| <i>Boronia alata</i> | Winged Boronia |
| <i>Casuarina obesa</i> | Swamp Sheoak |
| <i>Clematis linearifolia</i> | Old Mans Beard |
| <i>Desmocladius flexuosa</i> | |
| <i>Dianella revoluta</i> var. <i>divaricata</i> | Blueberry Lily |
| <i>Eremophila glabra</i> | Emu Bush |
| <i>Grevillea preissii</i> | |
| <i>Grevillea</i> sp. | |
| <i>Hakea prostrata</i> | Harsh Hakea |
| <i>Hardenbergia comptoniana</i> | Native Wisteria |
| <i>Isopogon asper</i> | |
| <i>Lechenaultia floribunda</i> | Free Flowering Lechenaultia |
| <i>Lepidosperma squamatum</i> | |
| <i>Leucopogon parviflorus</i> | Coast Beard Heath |
| <i>Macrozamia riedlei</i> | Zamia |
| <i>Melaleuca huegelii</i> | |
| <i>Melaleuca preissiana</i> | Chenille Honey Myrtle |
| <i>Melaleuca</i> sp. | |
| <i>Melaleuca systema</i> | Coastal Honey Myrtle |
| <i>Phyllanthus calycinus</i> | False Boronia |
| <i>Rhagodia baccata</i> | Berry Saltbush |
| <i>Scaevola nitida</i> | Shining Fan-Flower |
| <i>Scaevola</i> sp. | |
| <i>Spyridium globulosum</i> | Basket Bush |
| <i>Templetonia retusa</i> | Cockies Tongue |
| <i>Threlkeldia diffusa</i> | Coast Bonefruit |
| <i>Tricoryne elatior</i> | Yellow Autumn Lilly |
| <i>Xanthorrhoea preissii</i> | Grass Tree |

Table 15: Revegetation Species for Mosman Park Bushland

| Identified on site | Botanical Name | Common Name | Height | plants/ m ² | Zones | Low Species | Mixed Species |
|--------------------------------|--|-----------------------------|------------|------------------------|------------|-------------|---------------|
| TREES | | | | | | | |
| | <i>Agonis flexuosa</i> | Peppermint | 10m | 0.25 | 2,3 | | |
| | <i>Allocasuarina fraseriana</i> | Sheoak | 5 - 15m | 0.25 | 3 | | |
| | <i>Banksia attenuata</i> | Candle Banksia | 8m | 0.25 | 2,3 | | |
| | <i>Callitris preissii</i> | Rottneest Island Pine | 1-9m | 0.25 | 2 - 5 | | |
| | <i>Eucalyptus gomphocephala</i> | Tuart | 10 - 40m | 0.1 | 5,3 | | |
| | <i>Melaleuca lanceolata</i> | Rottneest Tea Tree | 5m | 0.25 | 5 | | |
| | <i>Melaleuca preissiana</i> | Moonah | 3 - 9m | 0.25 | | | |
| | <i>Santalum acuminatum</i> | Quandong | 1 - 7m | 0.5 | all | | |
| SHRUBS BETWEEN 1.5 - 5m | | | | | | | |
| | <i>Acacia cyclops</i> | Coastal Wattle | 0.8 - 4m | 0.5 | all | | |
| | <i>Acacia rostellifera</i> | Summer Scented Wattle | 1 - 6m | 0.5 | | | |
| | <i>Acacia pulchella</i> | Prickly Moses | 2m | 2 | all | | |
| | <i>Acacia saligna</i> | Orange Wattle | 1.5 - 6m | 0.5 | | | |
| | <i>Acacia truncata</i> | | 2m | 1 | 1 - 4 | | |
| | <i>Acacia xanthina</i> | White Stemmed Wattle | 1 - 4m | 0.5 | 2 - 4 | | |
| | <i>Alyxia buxifolia</i> | Dysentery Bush | 1 - 3m | 1 | | | |
| | <i>Banksia sessilis</i> | Parrot Bush | 0.5 - 5m | 0.5 | all | | |
| | <i>Boronia alata</i> | Winged Boronia | 0.3 - 2m | 1 | | | |
| | <i>Calothamnus quadrifidus</i> | One Sided Bottlebrush | 2m | | 1 - 4 | | |
| | <i>Dodonaea aptera</i> | Coast Hoppush | 3m | 1 | 2, 3, 4, 5 | | |
| | <i>Hakea prostrata</i> | Harsh Hakea | 1-3m | 2 | | | |
| | <i>Jacksonia sternbergiana</i> | Green Stinkwood | 3m | 1 | 3-May | | |
| | <i>Leucopogon parviflorus</i> | Coast Beard Heath | 0.3 - 3m | 1 | | | |
| | <i>Macrozamia riedlei</i> | Zamia | 0.5 - 3m | 1 | 1, 2, 3 | | |
| | <i>Melaleuca huegelii</i> | Chenille Honey Myrtle | 0.5 - 5m | 1.5 | 2, 3, 4, 6 | | |
| | <i>Melaleuca systema</i> | Coastal Honey Myrtle | 0.5 - 2m | 1 | all | | |
| | <i>Pittosporum phylliraeoides</i> | Native Apricot | 3m | 1 | 2, 3, 5 | | |
| | <i>Rhagodia baccata</i> | Berry Saltbush | 0.3 - 2m | 2 | | | |
| | <i>Scaevola crassifolia</i> | Thick Leaved Fan-Flower | 0.5m | 2 | 1, 2, 3 | | |
| | <i>Scaevola nitida</i> | Shining Fan-Flower | 0.3 - 3m | 2 | | | |
| | <i>Spyridium globulosum</i> | Basket Bush | 0.6 - 5m | 1 | 2, 4 | | |
| | <i>Templetonia retusa</i> | Cockies Tongue | 0.3 - 4m | 2 | 1, 2, 4, 5 | | |
| | <i>Xanthorrhoea preissii</i> | Grass Tree | 3m | 1 | 1 - 3 | | |
| SHRUBS LESS THAN 1.5M | | | | | | | |
| | <i>Acacia lasiocarpa</i> | Dune Moses | 1m | 2 | 1 - 4 | | |
| | <i>Acacia willdenowiana</i> | Grass Wattle | 0.5m | 2 | 1 - 4 | | |
| | <i>Allocasuarina humilis</i> | Dwarf Sheoak | 1.5m | 1 | 2 - 4 | | |
| | <i>Banksia dallanneyi</i> | | 0.5m | 2 | | | |
| | <i>Banksia nivea</i> | Couch Honeypot | 0.15 - 1m | 2 | 1, 2, 4 | | |
| | <i>Calothamnus sanguineus</i> | Silky Leaved Blood Flower | 1m | 1 | 1 - 4 | | |
| | <i>Diplopeltis huegelii</i> | | 1 - 1.5m | 1 | all | | |
| | <i>Eremophila glabra</i> | Emu Bush | 0.6m | 2 | all | | |
| | <i>Grevillea preissii</i> | | 0.5 - 1.5m | 2 | | | |
| | <i>Hovea pungens</i> | Devil's Pins | 0.5m | 2 | 1 - 4 | | |
| | <i>Hovea trisperma</i> | Common Hovea | 0.5m | 2 | 1 - 4 | | |
| | <i>Jacksonia sericea</i> | Waldjumi | 0.6m | 2 | 3 - 5 | | |
| | <i>Kennedia prostrata</i> | Running Postman | prostrate | 2 | all | | |
| | <i>Leucophyta brownii</i> | Cushion Bush | 0.5m | 2 | 1, 2, 4 | | |
| | <i>Lechenaultia floribunda</i> | Free Flowering Lechenaultia | 0.15 - 1m | 2 | | | |
| | <i>Lechenaultia linarioides</i> | Yellow Leschenaultia | 1m | 2 | 2, 3 | | |
| | <i>Logania vaginalis</i> | White Spray | 2m | 1 | 2, 5 | | |
| | <i>Olearia axillaris</i> | Coastal Daisy Bush | 1.5m | 1 | 1, 2, 4, 5 | | |
| | <i>Petrophile linearis</i> | Pixie Mops | 0.5 - 1m | 2 | all | | |
| | <i>Petrophile serruriae</i> | | 1m | 2 | all | | |
| | <i>Phyllanthus calycinus</i> | False Boronia | 0.2 - 1m | 2 | all | | |
| | <i>Threlkeldia diffusa</i> | Coast Bonefruit | 0.1 - 0.4m | 2 | | | |
| | <i>Trymalium ledifolium</i> | | 1.2m | 1 | 2, 3, 5 | | |
| SEDGES AND RUSHES | | | | | | | |
| | <i>Ficinia nodosa</i> | Knotted Club-Rush | 1m | 2 | all | | |
| | <i>Gahnia trifida</i> | Coast Saw-sedge | RUSH | 2 | 5 | | |
| | <i>Juncus kraussii</i> | Sea Rush | RUSH | 2 | 5 | | |
| | <i>Lepidosperma gladiatum</i> | Coast Sword Sedge | 1m | 2 | 5 | | |
| PERENNIAL HERBS | | | | | | | |
| | <i>Acanthocarpus preissii</i> | | 0.2 - 0.7 | 2 | | | |
| | <i>Anigozanthos humilis</i> | Cats paw | | 3 | 1 - 4 | | |
| | <i>Austrostipa elegantissima</i> | Feather Spear Grass | 2m | 2 | all | | |
| | <i>Conostylis candicans</i> | Grey Cottonheads | 0.5 | 3 | all | | |
| | <i>Desmodium flexuosus</i> | | 0.2 - 1.5m | 2 | | | |
| | <i>Dianella revoluta var. divaricata</i> | Blueberry Lily | 0.3-1.5m | 2 | all | | |
| | <i>Hemianthera pungens</i> | Snakebush | prostrate | 2 | all | | |
| | <i>Lobelia tenuior</i> | Slender Lobelia | 0.5m | 2 | all | | |
| | <i>Orthrosanthus laxus</i> | Morning Iris | 0.5m | 2 | all | | |
| | <i>Tricoryne elatior</i> | Yellow Autumn Lilly | 0.1 - 0.5m | 2 | | | |
| | <i>Lepidosperma squamatum</i> | | 0.15 - 1m | 2 | | | |
| ANNUAL HERBS | | | | | | | |
| | <i>Brachyscome iberidifolia</i> | Swan River Daisy | 0.05-0.45 | seed | all | | |
| | <i>Trachymene coerulea</i> | Blue Lace Flower | 0.5m | seed | all | | |
| CLIMBERS | | | | | | | |
| | <i>Clematis linearifolia</i> | Old Mans Beard | climber | 1 | 1 - 4 | | |
| | <i>Clematis pubescens</i> | White Clematis | climber | 1 | 1 - 4 | | |
| | <i>Hardenbergia comptoniana</i> | Native Wisteria | climber | 1 | all | | |

Appendix Three: Weed Species

South Mosman Park Bushland Management Plan

Table 16: Priority ratings of weed species in South Mosman Park Bushland

| WEED SPECIES | | PRIORITISATION | | | |
|---------------------------------|-----------------------------|----------------|-------------------------|--------------|----------|
| Scientific Name | Common Name | EWSWA Rating | Dixon & Keighery Rating | Final Rating | Priority |
| <i>Ehrharta calycina</i> | Perennial Veldt Grass | High | 1 | 6 | High |
| <i>Euphorbia terracina</i> | Geraldton Carnation Weed | High | 1 | | |
| <i>Lupinus cosentinii</i> | Western Blue Lupin | High | 1 | | |
| <i>Lycium ferocissimum</i> | African Boxthorn | High | | | |
| <i>Pelargonium capitatum</i> | Rose Pelargonium | High | 1 | | |
| <i>Avena barbata</i> | Bearded Oat | Moderate | 1 | 5 | |
| <i>Cynodon dactylon</i> | Couch | Moderate | 1 | | |
| <i>Lagurus ovatus</i> | Hares Tail Grass | High | 2 | | |
| <i>Arundo donax</i> | Giant Reed or False Bamboo | Unrated | 2 | 4 | Moderate |
| <i>Briza maxima</i> | Blowfly Grass | Moderate | 2 | | |
| <i>Chamelaucium uncinatum</i> | Geraldton Wax | Moderate | 2 | | |
| <i>Ferraria crispera</i> | Black Flag | Unrated | 2 | | |
| <i>Foeniculum vulgare</i> | Fennel | Unrated | 2 | | |
| <i>Lachenalia reflexa</i> | Yellow Soldiers | High | 3 | | |
| <i>Solanum nigrum</i> | Blackberry Nightshade | Moderate | 2 | | |
| <i>Arctotheca calendula</i> | Cape Weed | Moderate | 3 | | |
| <i>Hypochaeris glabra</i> | Smooth Cat's Ear, Flat Weed | Moderate | 3 | | |
| <i>Oenothera drummondii</i> | Beach Evening Primrose | Moderate | 3 | | |
| <i>Olea europaea</i> | Olive Tree | Moderate | 3 | 3 | |
| <i>Oxalis pes-caprae</i> | Soursob | Mild | 2 | | |
| <i>Sonchus oleraceus</i> | Common Sowthistle | Moderate | 3 | | |
| <i>Agave americana</i> | Agave, Sisal, Century Plant | Low | 3 | | |
| <i>Argyranthemum frutescens</i> | Marguerite Daisy | Low | 3 | | |
| <i>Cotula turbinata</i> | Funnel Weed | Low | 3 | 2 | Low |
| <i>Geranium molle</i> | Cranesbill | Low | 3 | | |
| <i>Lavandula stoechas</i> | French Lavender, Lavender | Low | 3 | | |
| <i>Medicago sp.</i> | Medic | Mild | 3 | | |
| <i>Parietaria judaica</i> | Wall Pellitory | Mild | 3 | | |
| <i>Pennisetum setaceum</i> | Fountain Grass | Mild | 3 | | |
| <i>Raphanus raphanistrum</i> | Wild Radish | Mild | 3 | | |
| <i>Ricinus communis</i> | Castor Oil Plant | Low | 3 | | |
| <i>Trachyandra divaricata</i> | Onion Weed, Dune Onion Weed | Mild | 3 | | |
| <i>Dimorphotheca ecklonis</i> | Veldt Daisy | Low | | | |
| <i>Lobularia maritima</i> | Alyssum, Sweet Alison | Low | | | |
| <i>Schinus terebinthifolius</i> | Japanese Pepper Tree | Unrated | | | |

Table 17: Weed Management of Weeds in South Mosman Park Bushland

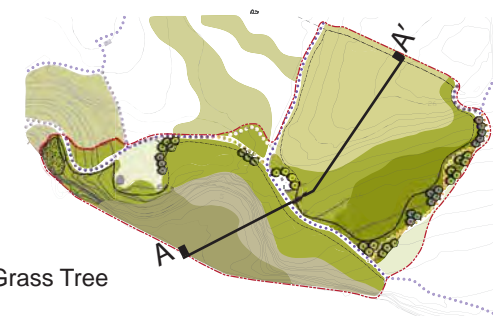
| WEED SPECIES | | CONTROL RECOMMENDATIONS | | | |
|--------------------------|-----------------------------|---|--|--|------------------|
| Scientific Name | Common Names | Manual Control | Wicker Wipe/ Cut Stump | Spot Spray @10L water + 25mL Pulse | Herbicide Timing |
| Agave americana | Agave, Sisal, Century Plant | Generally best to pull out (eg chain and tractor) or dig out. | Spear the centre of the plant with a crowbar and pouring in straight Roundup® when plant is actively growing. Alternatively, inject base leaves with 1:5 Tordon®75-D to diesel. | | Aug-Nov |
| Arctotheca calendula | Cape Weed | Manually remove small populations. | Wicker wipe with 1: 2 Roundup® to water. | <ul style="list-style-type: none"> 75 - 100mL Roundup® | Jun-Sep |
| Argyranthemum frutescens | Marguerite Daisy | Manually remove small infestations. | Wicker wipe with 1: 2 Roundup® to water. | <ul style="list-style-type: none"> 100mL Roundup® | May-Jul |
| Arundo donax | Giant Reed or Bamboo | | Cut to ground and treat stumps with straight Roundup®. | Selective Control <ul style="list-style-type: none"> 10mL Verdict® 10mL Targa® 10ml Fusilade® Non-selective control <ul style="list-style-type: none"> 100ml Roundup® | All Year Round |
| Avena barbata | Bearded Oat | Manually remove individuals before seeding. | Wicker wipe with 1:2 Fusilade®, Sertin®, Targa® or Roundup® to water. | Selective control <ul style="list-style-type: none"> 10mL Fusilade® 10mL Targa® 10mL Verdict® 5mL Sertin® Non-selective Control <ul style="list-style-type: none"> 100mL Roundup® | May-Aug |
| Briza maxima | Blowfly Grass | Manually remove individuals before seeding. | Wicker wipe with 1:2 Fusilade®, Sertin®, Targa® or Roundup® to water. | <ul style="list-style-type: none"> 4g Achieve® 40mL Sertin® 10mL Fusilade® 10mL Roundup® 200g Propon® | May-Sep |
| Chamelaucium uncinatum | Geraldton Wax | Manually remove seedlings. | Cut trees to ground level and treat stumps with straight Roundup®. | <ul style="list-style-type: none"> 100mL Roundup® | Sep-Nov |
| Cotula turbinata | Funnel Weed | Manually remove seedlings before seeding. | Wicker wipe with 1: 2 Roundup® to water. | <ul style="list-style-type: none"> 100ml Roundup 100mL Spray-seed®. | May-Sep |
| Cynodon dactylon | Couch | Shade out with black plastic during spring and autumn. | | Selective control <ul style="list-style-type: none"> 50mL Fusilade® 50mL Targa® 50mL Verdict® 20mL Sertin® Non-selective control <ul style="list-style-type: none"> 100mL Roundup® | All Year Round |
| Dimorphotheca ecklonis | Veldt Daisy | Manually remove seedlings before seeding. | Wicker wipe with 1: 2 Roundup® to water. | <ul style="list-style-type: none"> 100 mL Roundup® | Apr-Jun |
| Ehrharta calycina | Perennial Veldt Grass | Manual remove small populations before seeding. | Wicker wipe with 1:2 Fusilade®, Sertin®, Targa® or Roundup® to water. | Selective control <ul style="list-style-type: none"> 50 mL Targa® 50mL Sertin® 50mL Fusilade® 20 mL Verdict® Non-selective control <ul style="list-style-type: none"> 100 mL Roundup® | Aug-Sep |

| WEED SPECIES | | CONTROL RECOMMENDATIONS | | | |
|------------------------------|-----------------------------|--|---|--|------------------|
| Scientific Name | Common Names | Manual Control | Wicker Wipe/ Cut Stump | Spot Spray @10L water + 25mL Pulse | Herbicide Timing |
| <i>Euphorbia terracina</i> | Geraldton Carnation Weed | Manually remove individuals before seeding. | | <ul style="list-style-type: none"> 10-15mL Spray-Seed® | May-Jun |
| <i>Ferraria crispa</i> | Black Flag | Manually remove individual plants by extracting all soil within 20 of plant to ensure no corms are left in the soil. | Wicker wipe with 1: 2 Roundup® to water. | <ul style="list-style-type: none"> 100mL Roundup® + 0.5g metsulfuron methyl | Jul-Sep |
| <i>Foeniculum vulgare</i> | Fennel | Manually remove seedlings before seeding. | Cut to ground and treat stumps with straight Roundup®. | <ul style="list-style-type: none"> 100 mL Roundup® | Jun-Jan |
| <i>Geranium molle</i> | Cranesbill | Manually remove individuals before seeding. | Wicker wipe with 1: 2 Roundup® to water. | <ul style="list-style-type: none"> 100 mL Roundup® 0.1g Ally® 0.1g Brushhoff® | All Year Round |
| <i>Hypochaeris glabra</i> | Smooth Cat's Ear, Flat Weed | Use a weed fork to extract the taproot if hand pulling before seeding. | Wicker wipe with 1: 2 Roundup® to water. | <ul style="list-style-type: none"> 100ml Roundup® 50 mL Tordon®75-D | Aug-Nov |
| <i>Lachenalia reflexa</i> | Yellow Soldiers | In sandy soils use a knife or trowel to cut the roots and pull out when flowering. | Wicker wipe with 1: 2 Roundup® to water. | <ul style="list-style-type: none"> 100ml Roundup® 0.5g metsulfuron methyl | Apr-Jun |
| <i>Lagurus ovatus</i> | Hares Tail Grass | Manually remove individuals before seeding. | | Selective control <ul style="list-style-type: none"> 10mL Fusilade® 10mL Targa® 10mL Verdict® 5mL Sertin® Non-selective Control <ul style="list-style-type: none"> 100mL Roundup® | Jun-Sep |
| <i>Lavandula stoechas</i> | French Lavender | Manually remove individuals before seeding. | Wicker wipe with 1: 2 Roundup® to water. | <ul style="list-style-type: none"> 100mL Roundup® | All Year Round |
| <i>Lobularia maritima</i> | Alyssum, Sweet Alison | Manually remove individuals. | | <ul style="list-style-type: none"> 50-75mL Roundup® | All Year Round |
| <i>Lupinus cosentinii</i> | Western Blue Lupin | Manually remove small populations before seeding. | Wicker wipe with 1: 2 Roundup® to water. | <ul style="list-style-type: none"> 200mL Roundup® 100mL Lontrel® 1g Logran® 20mL Tordon®75-D | May-Aug |
| <i>Lycium ferocissimum</i> | African Boxthorn | Manually remove seedlings. | Cut plant to ground and treat stump with straight Roundup®. | <ul style="list-style-type: none"> 100mL Roundup® | All Year Round |
| <i>Medicago sp.</i> | Medic | Manually remove individuals. | | <ul style="list-style-type: none"> 50-75mL Roundup® | Jun-Oct |
| <i>Oenothera drummondii</i> | Beach Evening Primrose | Manually remove individuals. | Wicker wipe with 1: 2 Roundup® to water. | <ul style="list-style-type: none"> 100mL Roundup® 1g Logran® | All Year Round |
| <i>Olea europaea</i> | Olive Tree | Manually remove individual seedlings. | Cut mature plants to ground and treat stump with straight Roundup®. | <ul style="list-style-type: none"> Seedlings - 100mL Roundup® <2 year old plants – 15mL Garlon® | All Year Round |
| <i>Oxalis pes-caprae</i> | Soursob | Manually remove individuals. | Wicker wipe with 1: 2 Roundup® to water. | <ul style="list-style-type: none"> 0.5g Ally® 0.5g Brushhoff® 75mL Roundup® | Jun-Oct |
| <i>Parietaria judaica</i> | Wall Pellitory | Manually remove individual seedlings. | Wicker wipe with 1: 2 Roundup® to water. | | Dec-Jan |
| <i>Pelargonium capitatum</i> | Rose Pelargonium | Carefully pull plants of small populations in autumn/winter when soil is damp. Ensure to remove entire plant as plant will reshoot if stem is broken at or below ground level. | Wicker wipe with 1: 2 Roundup® to water. | Selective control <ul style="list-style-type: none"> 100mL Tordon®75-0 20mL 2,4-0 amine(500g/L) Non-selective control <ul style="list-style-type: none"> 100mL Roundup® | All Year Round |
| <i>Pennisetum setaceum</i> | Fountain Grass | Manual remove small populations before seeding. | Wicker wipe with 1:2 Fusilade®, Sertin®, Targa® or Roundup® to water. | Selective control <ul style="list-style-type: none"> 5mL Targa® 5mL Sertin® 5mL Fusilade® 2mL Verdict® Non-selective control <ul style="list-style-type: none"> 100mL Roundup® | Jun-Aug |

| WEED SPECIES | | CONTROL RECOMMENDATIONS | | | |
|--------------------------|-----------------------------|---|---|---|------------------|
| Scientific Name | Common Names | Manual Control | Wicker Wipe/ Cut Stump | Spot Spray @10L water + 25mL Pulse | Herbicide Timing |
| Raphanus raphanistrum | Wild Radish | Manually remove small populations before seeding. | Wicker wipe with 1: 2 Roundup® to water. | <ul style="list-style-type: none"> 100mL Roundup® 10mL Brodal® | All Year |
| Ricinus communis | Castor Oil Plant | Manually remove seedlings. | Cut plant to ground and treat stump with straight Roundup®. | <ul style="list-style-type: none"> 125mL Roundup® | All Year Round |
| Schinus terebinthifolius | Japanese Pepper Tree | Manually remove small populations of seedlings. | Inject trunk with 50% Roundup®, cut to near ground level and treat stump with straight Roundup® within 30 seconds of cutting. | | All Year Round |
| Solanum nigrum | Blackberry Nightshade | Manually remove small populations before seeding. | Wicker wipe with 1: 2 Roundup® to water. | <ul style="list-style-type: none"> 30mL Spray-Seed® 200mL Roundup® 20mL Access® 20mL Starane® | Sep-Dec |
| Sonchus oleraceus | Common Sowthistle | Manually remove individuals before seeding. | Wicker wipe with 1: 2 Roundup® to water. | <ul style="list-style-type: none"> 50-75mL Roundup® 100mL Tordon®75-D | Sep-Dec |
| Trachyandra divaricata | Onion Weed, Dune Onion Weed | Manually remove individuals before seeding. | Wipe with 1g Ally® or Brushoff® to 1L water. | <ul style="list-style-type: none"> 0.5g Ally® 0.5g Brushoff® | Aug-Sep |

Table 18: Information of Recommended Herbicides

| Herbicide Brand | Active ingredients | Type | WA Registered | Aust Registered |
|-----------------|---|------|---------------|-----------------|
| Access® | 50% 2,4-D amine w/w | I | * | * |
| Ally® | 60% metsulfuron methyl w/w | B | | |
| Brodal® | 50% diflufenican, 5% propane-1,2-diol w/w | F | * | * |
| Brushoff® | 60% metsulfuron methyl w/w | B | | |
| Fusilade® | 21.2% fluazifop-p butyl ester w/v | A | * | * |
| Garlon® | 71.7% triclopyr butoxyethyl ester, 20% diethyl glycol monoethyl ester w/v | I | * | * |
| Logran® | 75% triasulfuron w/v | B | * | * |
| Lontrel® | 59.1% clopyralid w/w | I | * | * |
| Propon® | 74% 2,2 DPA w/w | J | | |
| Roundup® | 36% glyphosate w/v | M | * | * |
| Sertin® | 18.6% sethoxydim w/v | A | * | * |
| Spray-Seed® | 13.5% paraquat dichloride, 11.5 % diquat dibromide w/v | L | | |
| Starane® | 30.3% fluroxypyr methylheptyl ester w/v | I | * | * |
| Targa® | 10.3% quizalofop-p-ethyl w/v | A | * | * |
| Tordon® 75D | 47.2% 2,4-D TIPA, 7.5% picloram TIPA w/v | I | * | * |
| Verdict® | 48% haloxyfop r-methyl ester, 43.4% diethylene glycol monoethyl ether w/v | A | * | * |



Callitris preissii Rottnest Cyprus



Calothamnus quadrifidus One Sided Bottle Brush



Agonis flexuosa Peppermint



Xanthorrhoea preissii Grass Tree



Melaleuca heugelli Chenille honeymyrtle



Eremophila glabra Tar Bush



Eucalyptus gomphocephala Tuart



Acacia cyclops Coastal Wattle



Olearia axillaris Coastal Daisy Bush



Petrophile linearis Pixie Mops



Allocasuarina fraseriana Common Sheoak



Leucophyta brownii Cushion Bush



Ficinia nodosa Knotted Club Rush



Acacia willdenowiana Grass Wattle



Banksia attenuata Candle Banksia



Macrozamia riedlei Zamia Palm



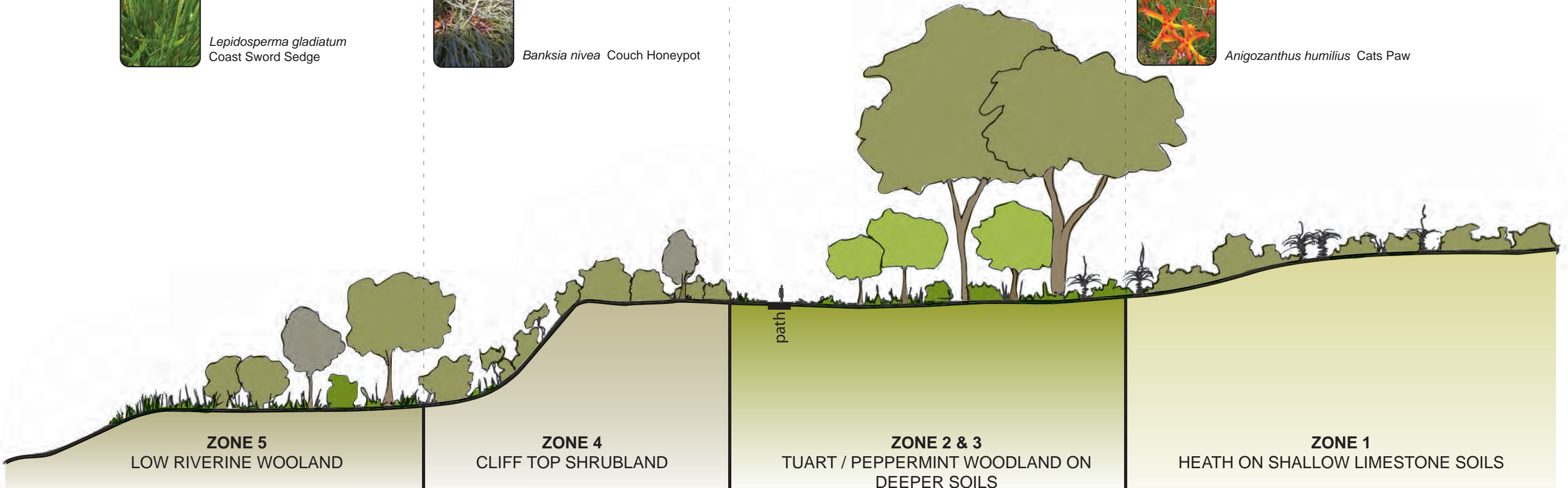
Lepidosperma gladiatum Coast Sword Sedge



Banksia nivea Couch Honeypot



Anigozanthus humilii Cats Paw



South Mosman Park Bushland Management Plan

Section through Vegetation Communities

Map 8

October 2008

Town of Mosman Park

0 50 100 150m

Scale 1:500 @ A3. (This Plan is Diagrammatic Only)
Project No. 2062-08

